DOCUMENT RESUME

ED 275 564 SE 047 571

AUTHOR Katz, Elaine; And Others
TITLE Electricity. Physical Science in Action. Teacher's Manual and Workbook.
REPORT NO ISBN-0-915510-77-4
PUB DATE 82
NOTE 55p.
AVAILABLE FROM Janus Book Publishers, Inc., 2501 Industrial Parkway West, Hayward, CA 94545 ($2.85).
PUB TYPE Guides - Classroom Use - Materials (For Learner) (051) -- Guides - Classroom Use - Guides (For Teachers) (052) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Educationally Disadvantaged; Electric Circuits; *Electricity; Elementary Education; *Elementary School Science; Heat; Light; *Physical Sciences; Problem Solving; Safety Education; *Science Activities; Science Education; *Science Instruction; Slow Learners; *Special Education
IDENTIFIERS Special Needs Students

ABSTRACT

The Science in Action series is designed to teach practical science concepts to special-needs students. It is intended to develop students' problem-solving skills by teaching them to observe, record, analyze, conclude, and predict. This document contains a student workbook which deals with basic principles of physical science. Seven separate units are entitled: (1) a special path; (2) on and off; (3) go with the flow; (4) electric light; (5) hot wires; (6) beware of bare wires; and (7) watch out. The units consist of basic introductory information and questions, worksheets, a self-checking quiz, and instructions for experiments. A cumulative test is provided at the end of the workbook, along with a glossary. The teachers guide (which is included) explains how to use the workbook, together with teaching suggestions and enrichment activities for each unit. (TW)

**********
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
**********

# Electricity

## Physical Science in Action

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Jana Brundage

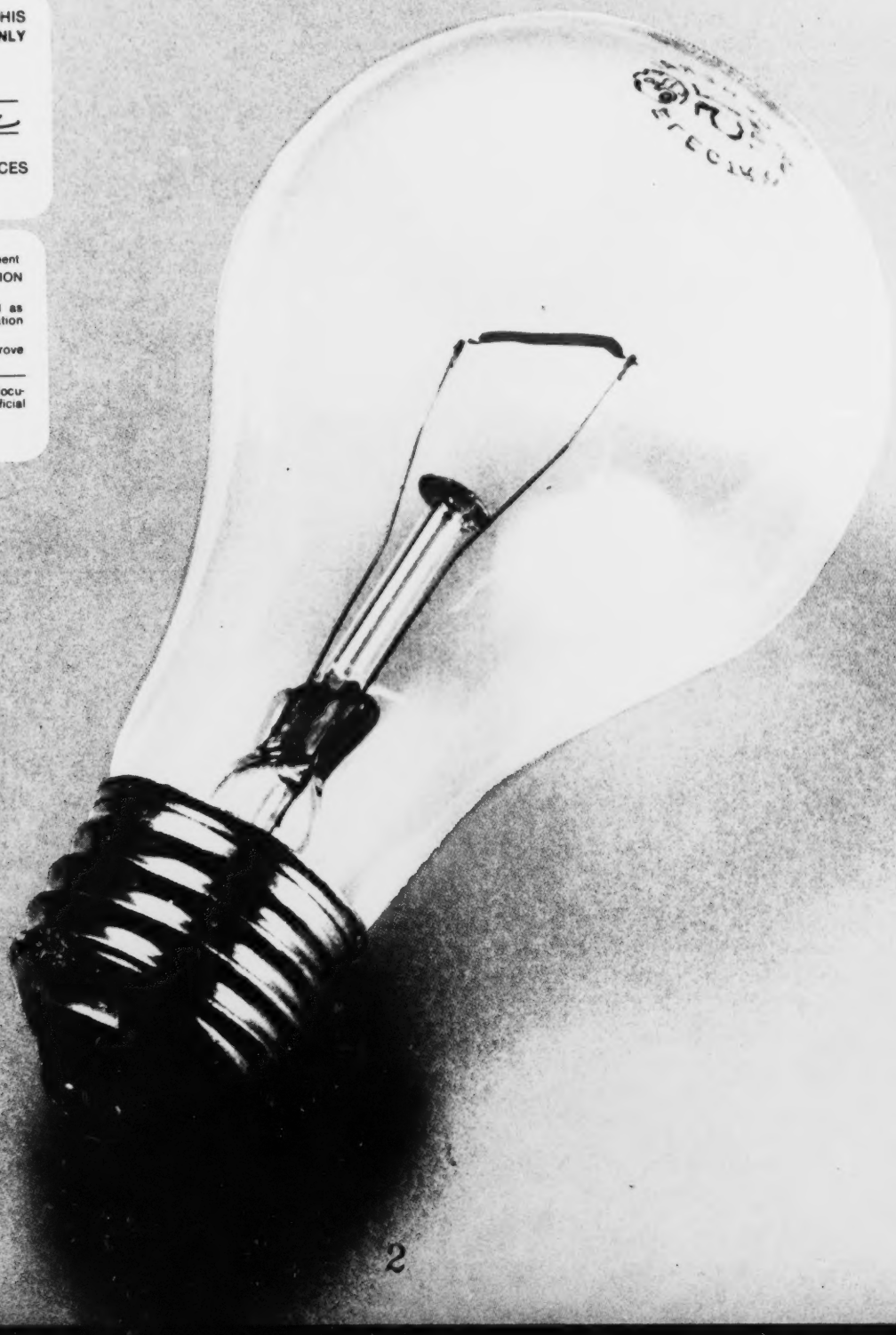
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.



SE047 571

# Electricity

## Physical Science in Action

by Elaine Katz and Richard S. Kolbert

**Science consultant:**
Gilbert Yee
California Teacher of the Year
Fremont, California

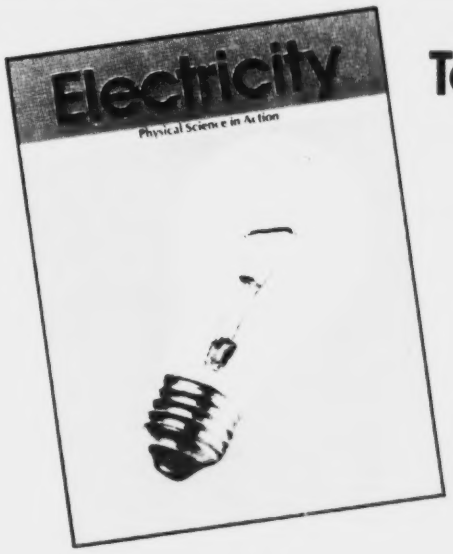
## Contents

Introduction 3
Unit 1 A Special Path 4
Unit 2 On and Off 11
Unit 3 Go with the Flow 17
Unit 4 Electric Light 23
Unit 5 Hot Wires 29
Unit 6 Beware of Bare Wires 35
Unit 7 Watch Out! 41
Show What You Learned 46
Glossary 47

International Standard Book Number 0-915510-77-4

Copyright © 1982 by Janus Book Publishers, 2501 Industrial Parkway West, Hayward, CA 94545. All rights reserved. No part of this book may be reproduced by any means, or transmitted, or translated into a machine language without the written permission of the publisher.

Printed in the United States of America. 6 7 8 9 0 0 9 8 7 6 5 4




# Teacher's Manual

# Electricity

Elaine Katz and Richard S. Kolbert

A Janus **Physical Science in Action** Book

*Teacher's Manual written by Harry W. Wittenberg*

## OVERVIEW

### Making Science Relevant

We believe that reluctant learners can become interested in science. How? By being successfully involved with their own learning, and by learning things they can use in their daily lives. We designed ***Electricity*** to help them do both.

*Electricity* was written specially for the older adolescent with reading and learning problems. Through "hands-on" experiments and activities, students learn about current electricity. Students also learn how to use electricity safely and how to remedy simple and common electrical hazards.

### Designed for Successful Learning

*Electricity* is organized so that the learning-handicapped student can succeed. Lessons are one or two pages long. Each lesson teaches one major concept, and each concept is broken down into clear, concise steps. Following each lesson are activities and experiments that reinforce students' comprehension. All the lessons can be expanded and modified to meet the different skills levels of your students.

*Electricity* is part of a set of Janus ***Physical Science in Action*** workbooks. It can be used as a supplement to or as the core of your science program. Other Janus sets are ***Life Science in Action*** and ***Earth Science in Action.*** All Janus *Science in Action* workbooks can help special-needs students meet general and laboratory science graduation requirements.

## OBJECTIVES OF THIS WORKBOOK

The Janus *Science in Action* series is designed to help special-needs students learn basic science concepts that have practical applications. It also helps students develop problem-solving and thinking skills by teaching them to observe, record, analyze, conclude, and predict.

The objectives of *Electricity* are:

- The student will learn that electricity travels in a circuit.
- The student will learn how to construct a simple circuit, switch, and fuse.
- The student will learn how electricity produces heat and light.
- The student will learn some tips for using electricity safely.
- The student will learn a basic vocabulary relating to electricity and its use.

## READABILITY

The average reading level of *Electricity* is below 2.5, according to the revised Spache Readability Formula. Target words in this book are highlighted in boldface type when they first appear. These words are defined in a glossary at the end of the book, and are listed under "Teaching the Units" in this manual.

We suggest that you preview the target words before students begin a unit. Help students pronounce and define each word. Encourage students to use the glossary.

Copyright © 1982 by Janus Book Publishers, 2501 Industrial Parkway West, Hayward, CA 94545. All rights reserved.

## HOW TO USE THIS WORKBOOK

### The Workbook Format

*Electricity* is formatted to help students recognize what to do on each page.

Units 1 through 6 all begin with an introduction that presets learning. Topic questions focus the students' attention on the concepts they'll learn. "Before You Start," a vocabulary exercise, asks students to look up target words in the glossary.

Lessons are presented in one or two pages for easy handling. Each lesson is followed by an activity or experiment that reinforces learning.

Each of the units ends with "Check Yourself," a comprehensive exercise, and "Check These Out," a list of supplementary activities for students at various levels of interest and ability.

Unit 7 departs from the format of earlier units and focuses on safety. Students are asked to apply the basic concepts they learned in the first six units.

### Introducing the Book

Ask your students to tell about their experiences with electricity. For example, ask them what electrical appliances they use, if they've had accidents involving electricity, and so on. You may want to begin the discussion by relating an experience you've had with electricity.

Give the students their workbooks. Let them leaf through the pages. Then have a student read the introduction out loud. You might ask: *What activities mentioned in the introduction can be done without electricity?*

### Introducing the Units

Have a student read the unit introduction out loud. Ask students to guess answers to the topic questions. (You might have them answer those questions again at the end of the unit so they can see how much they've learned.)

Then introduce the "Before You Start" words. Have students look them up in the glossary. You can also have students look up other target words (words in boldface type) in the unit. Make sure your students understand the target words. Those words were specially chosen to help students learn the concepts in that unit.

### Teaching Suggestions

#### Help Your Students Succeed

We strongly suggest that you structure your teaching so students work in a group. This will enable you to reinforce concepts and guide activities and experiments. You can direct the faster students to "Check These Out" (or other enrichment activities), while slower members of the group complete their work.

When your students encounter a new kind of activity, or have difficulty doing an activity, walk them through it. As they gain confidence, they'll be able to complete similar activities more independently.

Closely supervise students as they work on the activities and experiments. Help them reach correct conclusions. You may want them to work as teams. Or you may want to give demonstrations while your students watch. Encourage students to talk about what they've done and what they've learned.

#### Be Prepared!

You will feel most comfortable teaching *Electricity* if you are thoroughly prepared. We suggest that you read through an entire unit before you begin teaching it. Gather all materials you'll need in advance. (You should be able to find them at home or in a hardware store.) Try out the activities and experiments. Anticipate questions or problems that may arise.

You may want to read background information on current electricity. The bibliography at the end of this manual suggests sources. The bibliography can also help you develop supplementary lessons on static electricity, electromagnetism, and other related topics.

### End-of-the-Book Exercises

"Show What You Learned" is a comprehensive test that marks the completion of *Electricity*. "What's the Answer?" tests students' comprehension of major concepts, and "What's the Word?" tests students' knowledge of target words.

### About the Glossary

All the target words in *Electricity* are listed in the glossary. The words are alphabetized and divided into syllables. Definitions are purposely narrow. They provide only the information students need to understand the concepts in *Electricity*.

## TEACHING THE UNITS

### Unit 1: A Special Path

**Target Words:** *battery, bulb, circuit, flow, posts*

This unit teaches students that electricity flows in a continuous path called a circuit. In this workbook, *electricity, electrical energy,* and *electrical current* are used interchangeably. You might want to very simply describe to the class the nature of electricity.

Generally, electricity is the flow of free electrons. Electrons (negatively charged particles) orbit around the nucleus of atoms. Free electrons are those electrons in the outermost orbits that can break away and move to another point. When they move, they release electrical energy.

PAGE 5: **There and Back Again**

Students learn that electricity flows continuously in a circuitous path. It leaves a starting point (a source), moves through the path, returns to the starting point, and flows out into the path again. Students kinesthetically reinforce learning by connecting all the dots on a diagram that shows how the flow in a circuit generally travels.

This page also discusses sources of electricity, such as a generator. A battery is used to make a flashlight work.

PAGES 6–7: **Make a Circuit**

**Materials:** *bell wire, small socket and bulb* (such as those used to light up house numbers), *six-volt battery*

We suggest that you strip the wires first before your students come in. You might want to pair students for this activity. Students build a simple circuit and learn that the parts of a circuit must connect with each other for electricity to flow. Guide students through this activity. The bulb will not light up unless all connections are made, so check your students' work carefully.

PAGE 7: **What's Happening?**

**1.** The battery makes electricity. **2.** The wires make a path. **3.** The bulb lights up.

PAGES 8–9: **Experiment 1—What happens when you open a circuit?**

**Materials:** *your completed circuit*

Students learn that electricity flows in a closed circuit and stops flowing in an open circuit. The terms *materials, procedure, observations,* and *conclusion* are introduced. Explain these terms to your students prior to the experiment. You might point out to students that those terms describe the steps that scientists go through when they look for information. Again, guide students carefully through the experiment. Check all connections on those circuits that don't work.

**Observations: 1.** The bulb goes off when you open a circuit. **2.** The bulb goes on when you close the circuit.

**Conclusion:** Electricity stops flowing when you open a circuit.

PAGE 10: **Check Yourself**

**Answers to puzzle:** *Across* **1.** electricity **3.** closed **4.** battery **5.** flows *Down* **2.** circuit **4.** bulb

**Enrichment Activities**

- Make a duplicating master that shows several circuits like the one students made. Have some circuits open and some closed. Have the students label them.
- Invite a specialist, such as a cable splicer from the electric company, to talk to the class about his or her job.
- Discuss with your students the positive (+) and negative (−) signs on batteries. Examine a battery with your students and show them the direction that electrons move in. (Briefly: free negatively charged electrons move freely from a negative source to a positive source.)

## Unit 2: On and Off

**Target Words:** *control, switch*

Students learn that the flow of electricity can be controlled by opening and closing a circuit with a switch. You might want to introduce the unit by discussing how the flow of familiar things is controlled. Some examples are: water faucets (flow of water); traffic lights (flow of traffic); gates and doors (flow of people).

PAGE 12: **You're in Control**

A switch lets people control electricity without handling wires. Switches close circuits so electricity can flow; they open circuits to stop the flow.

Discuss the diagram on this page and make sure students understand it. It appears again in the next activity.

PAGE 13: **Open or Closed?**

Students examine two diagrams that show switches opening and closing circuits. Diagram A shows an open switch. Diagram B shows a closed switch.

**Answers: 1.** The lamp in Diagram A is *Off.* **2.** The lamp in Diagram B is *On.* **3. a.** When the switch *opens* the circuit, electricity stops flowing and the lamp is off. **b.** When the switch *closes* the circuit, electricity starts flowing and the lamp is on.

PAGES 14–15: **Make a Switch**

**Materials:** *lightweight cardboard, bell wire, two brass fasteners, paper clip, the circuit*

Students make a simple switch out of common materials. We suggest you strip the ends of the wires before your students do this activity. To ensure everyone's success, keep students together. Guide them through the activity step by step.

PAGE 16: **Check Yourself**

**1.** (You can use a switch) **c.** to control electricity.
**2.** (A switch opens or) **a.** closes a circuit.
**3.** (Electricity flows through) **d.** a closed circuit.
**4.** (Electricity can't flow through) **b.** an open circuit.

**Enrichment Activities**

- Write for information, posters, etc., from an electrical association, union, or manufacturer of switches. (See "Resources" at the end of this manual for some possible addresses.)
- Make a self-checking quiz board, following the principles of a circuit. Punch a row of holes in two opposite edges of a piece of cardboard. Push brass fasteners through the holes. On the back side of the cardboard, use bell wire to connect each fastener in one row to a fastener in the other row.

On the front side of the board, write a question next to each fastener head in one row. Write the answer next to the fastener head in the other row that's connected to it.

Attach two bell wires to the posts of a battery. Wrap the stripped end of one of the wires around the base of a flashlight bulb. Wrap the stripped end of the other wire around a paper clip.

Students quiz themselves by touching the paper clip to a fastener head next to a question. At the same time, they touch the flashlight bulb's base to the fastener head next to an answer. If the answer is correct, the bulb will light up.

## Unit 3: Go with the Flow

**Target Words:** *conduct, conductor, nonconductor, shock*

Students learn that electricity flows only through certain materials (conductors) and not through others (nonconductors).

PAGE 18: **Cover Story**

Electricity flows through the metal center of a wire. Electricity cannot flow through the wire's covering, which is made of a nonconductor. You might introduce your students to the words *insulator* and *insulation*.

Coverings for wires are usually made of rubber or plastic materials. If a wire had no covering, electricity could flow out of the wire.

Students look at the picture on the page and identify the two parts of a wire. The covering is the *nonconductor;* the wire is the *conductor.*

PAGE 19: **Which is Which?**

Students guess which of eight things are conductors and nonconductors. You might add to the list by having students select and guess about items in the room. Students can write their guesses on the bottom of the page.

PAGES 20–21: **Experiment 2—Which things are conductors?**

**Materials:** *penny, rubber band, glass, metal key, wood toothpick, metal nail, metal knife, plastic spoon, your circuit and battery*

In this experiment, students find out if they correctly guessed which items on page 19 are conductors and which are nonconductors. If students guessed about additional items, have them test those items too.

**Observations:** **1.** penny (metal); key (metal); knife (metal); nail (metal) **2.** rubber band (rubber); glass (glass); toothpick (wood); spoon (plastic)

**Conclusions:** **1.** Electricity can flow through *metal.* **2.** Electricity can't flow through *rubber, glass, plastic, wood.* **3.** The things made of *metal* are conductors.

PAGE 21: **How did you do?**

Students check their guesses. If students added other items to the list, have them explain why they thought those items would make conductors or nonconductors.

PAGE 22: **Check Yourself**

**Answers to puzzle:** *Across* **4.** nonconductor **6.** glass **8.** plastic **9.** rubber *Down* **1.** conduct **2.** metal **3.** wood **5.** conductor **7.** shock

**Enrichment Activities**

- Set up a conductor/nonconductor test center in the room. Have students contribute test items.
- Saw open an old battery. Point out the different parts of the battery to your students.

## Unit 4: Electric Light

**Target Words:** *cord, filament, glows, incandescent*

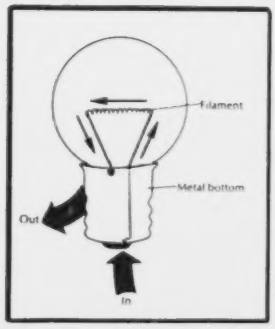
Now that students know that electricity flows in a circuit, they can understand how it flows through a bulb to make it light up. Help students see that electricity flows through other appliances, such as toasters, in much the same way.

PAGE 24: **It's So Hot, It Glows**

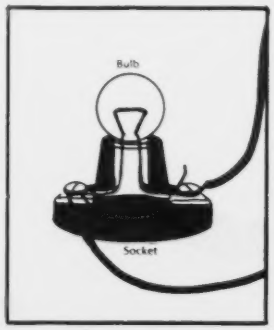
Students learn that a thin wire will produce light when heated by electricity. Generally, a light bulb works this way: The bulb encloses a wire filament made of a material that is somewhat resistant to the flow of electricity. This resistance causes the wire to heat up until it glows. The bulb keeps air out to prevent the filament from burning up too rapidly.

Students draw the path of electricity on the picture of a bulb. Electricity flows out through the metal bottom of the bulb.

Page 24




Page 25




PAGE 25: **Back to the Circuit**

Students learn how electricity flows through a light bulb when it is part of a circuit. On the picture, students draw the path electricity takes.

PAGES 26–27: **Two-Way Traffic**

**Materials:** *lamp cord (with plug), battery, students' switch, bulb and socket*

In this activity students see how a lamp cord conducts electricity to and from a lamp.

**WARNING:** Do not let students plug the cord into a wall socket. At the end of the activity, remove the cord and put it away.

PAGE 28: **Check Yourself**

**1.** The thin wire in a light bulb is called a *filament.* **2.** The filament is made of a special *metal.* **3.** When

the filament gets very hot, it *glows*. **4.** An *incandescent* bulb is a light bulb that has a filament. **5.** There are two wires in an electric *cord*. **6.** Electricity follows a *metal* path.

**Enrichment Activities**

- Bring to class a variety of wires of different gauges and metals. Discuss resistance, high voltage wiring, etc.
- Write to a wire manufacturer for information on different types of wire.

## Unit 5: Hot Wires

**Target Words:** *appliance, circuit breaker, fuse, fuse box, outlet, overloaded*

Students learn about fuses and the dangers of overloaded circuits. In house wiring, the main circuits are connected to a fuse box to avoid overloading.

PAGE 30: **A Lot of Electricity**

Appliances that heat up, such as toasters, use more electricity than light bulbs. Generally, this is because a high amount of electricity is needed to produce heat. (The more resistant a material is, the more heat it will produce.)

You might demonstrate the difference between amounts of electricity needed. Set up a toaster and light bulb. Light the bulb and heat the toaster. Have your students place their hands near the toaster and then near the bulb. Ask which appliance uses more electricity. Focus discussion by asking: *Which glows brighter—the toaster or the light bulb? Which gets hotter? In what ways are the toaster and the bulb the same? In what ways are they different?*

**CAUTION:** Monitor this activity very carefully. Do not let your students touch either appliance.

PAGE 31: **Danger! Overload!**

Students are asked which appliances need large amounts of electricity. Besides the ones pictured, you may suggest: hot plate, electric stove, electric heater. Ask students if they have noticed potentially overloaded circuits in their home. Ask what they would do if they saw an overloaded circuit.

A bonus activity might be to have students do a home survey. Design a survey form so students can note the number of electric appliances, light switches, light sockets, wall outlets, electric appliances per outlet, and circuit breakers or fuses.

PAGE 32: **Keeping It Safe**

Students learn that an overloaded circuit will get hot enough to cause a fire unless the circuit is broken. Fuses and circuit breakers are safeguards against the dangers of overload.

To demonstrate that the metal strip in a fuse melts, get a good fuse (a car fuse will do), take out the metal strip, and hold it over a match flame. The strip will melt.

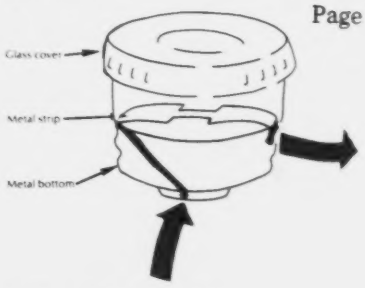
Fuse boxes are placed in basements, closets, hallways, and outside the house.

PAGE 33: **Flowing through a Fuse**

Students examine a fuse and identify its important parts: the metal bottom and the metal strip. Have students guess the purpose of the glass cover. (It protects the thin metal strip.)

Electricity goes into the metal bottom first, flows through the metal strip, and comes out of the metal bottom again. On the picture, students draw the path electricity takes.

Page 33




PAGE 34: **Check Yourself**

**1.** (Appliances that make heat need) **c.** large amounts of electricity. **2.** (A fuse can open a circuit) **a.** and keep it safe. **3.** (The strip in a fuse melts if) **d.** too much electricity flows through it. **4.** (An overloaded circuit can) **b.** start a fire.

**Enrichment Activities**

- Invite someone from the fire department to talk about electrical safety in the home.
- Bring in different kinds of fuses and circuit breakers and discuss them.
- Show a filmstrip on electrical safety.

## Unit 6: Beware of Bare Wires

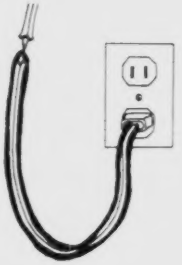
**Target Words:** *bare, short circuit*

Students learn what a short circuit is, its dangers, and how it can be prevented. House circuits can become overloaded when old, frayed, or damaged wires cause a short circuit.

PAGE 36: **The Shortest Path**

A short circuit occurs when bare wires of a circuit touch, causing electricity to flow back to its source without completing the longer circuit.

Students draw the path of electricity in a short circuit.



PAGES 37–39: **Experiment 3—What happens with a short circuit?**

**Materials:** *six-volt battery, bulb and socket, wire, steel wool, spool of thread, rubber band*

Students see how a short circuit becomes overloaded. The steel wool will burn, just as the metal strip in a fuse will melt, when too much electricity flows through it.

This is the most elaborate experiment in the book. Guide your students carefully through each step.

**Observations: 1.** The bulb goes out when the bare wires touch. **2.** The steel wool burns when the bare wires touch.

**Conclusions: 1.** When the bare wires touch, they make a *short* circuit. **2.** Too much *electricity* flows through the wires. **3.** The circuit is *overloaded*. **4.** The steel wool *opens* the circuit like a fuse.

PAGE 40: **Check Yourself**

**Answers to puzzle:** *Across* **2.** short circuit **5.** bare **6.** hot *Down* **1.** fuse **3.** overloaded **4.** covering

**Enrichment Activities**

- Plan a trip to a construction site to see the wiring of a building.
- Bring in broken appliances for the class to examine. Have students discuss what's wrong with each appliance.
- Make a list of places in a home where electrical accidents might happen. Make another list of precautions.

## Unit 7: Watch Out!

Students learn some simple rules of electrical safety. Other safety tips are: Always replace a blown fuse with a new one like it; never put a foreign object, such as a penny, into a fuse socket; turn off all switches near the appliance that caused a blown fuse before replacing the fuse.

PAGE 42: **What's Wrong?**

**1.** The covering on the cord has come off. **2.** The bare wires could touch and blow a fuse. When bare wires touch, they cause a short circuit. Too much electricity then flows through the circuit. **3.** Have a new cord put on.

PAGE 43

**1.** Too many appliances are plugged into the same outlet. **2.** The circuit could become overloaded. Too much electricity for one circuit is being used. **3.** Plug some of the appliances into another outlet in another part of the room.

PAGE 44

**1.** The cord is in a place where people will walk on it. **2.** The covering can break and cause a short circuit. Walking on the wire can wear out the covering. **3.** Put the lamp near the outlet to keep the cord out of the way.

PAGE 45

**1.** The woman is touching the radio with wet hands. **2.** She could get a shock. The water on her hands could conduct electricity. **3.** Dry your hands before touching anything electrical.

**Enrichment Activities**

- Have a class discussion on this topic: How would you handle an electrical emergency in your house?
- Take a field trip to a science museum that exhibits the many uses of electricity.
- Set up a science exhibit and have your students explain it to visiting classes.

## Show What You Learned

PAGE 46: **What's the Answer?**

**1. a.** A closed circuit **2. a.** Water **c.** Metal
**3. b.** Heat **c.** Light **4. a.** Short **b.** Overloaded

PAGE 46: **What's the Word?**

**1.** Circuit **2.** Switch **3.** Conductor **4.** Filament
**5.** Overloaded **6.** Fuse

## TEACHING AIDS

### Resources

- Electrical Apparatus Association, 1331 Baur Boulevard, St. Louis, MO 63132
- Consumer Federation of America, 1012–14th Street NW, Washington, D.C. 20005
- Electrical Power Research Institute, Box 10412, Palo Alto, CA 94303
- Occupational Health and Safety Association (OSHA). Look up regional office.

### Bibliography

*Edison Experiments You Can Do*, by Marjorie Van Der Water. Harper & Bros., 1960.

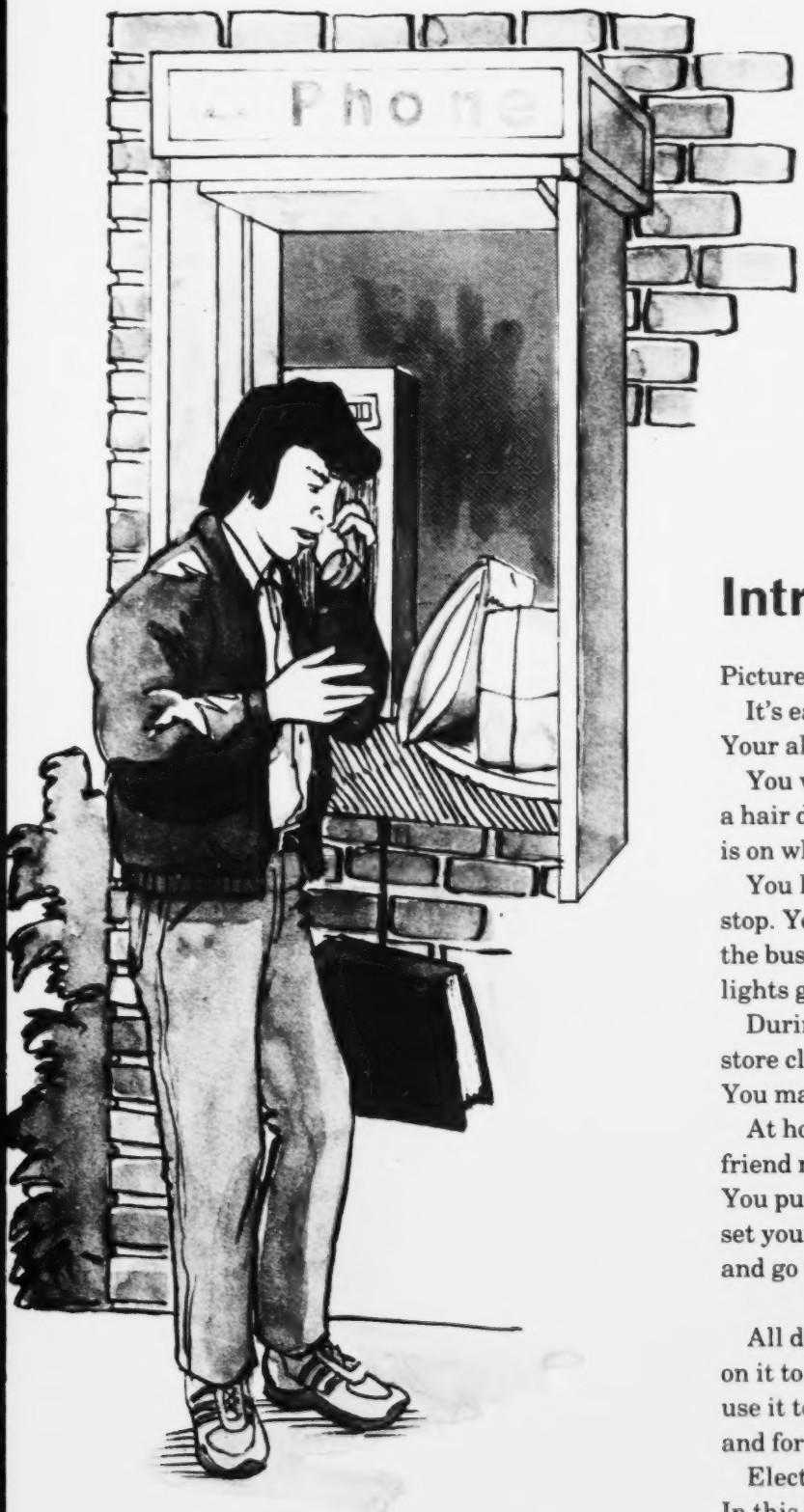
*The First Book of Electricity*, by Beryl Epstein & Sam Epstein. Franklin Watts, 1977.

*A First Electrical Book for Boys*, by Alfred Morgan. Charles Scribner's Sons, 1963.

*What Makes a Light Go On?*, by Scott Corbett. Little, Brown and Company, 1966.

*Wires and Watts: Understanding and Using Electricity*, by Irwin Math. Charles Scribner's Sons, 1963.

*The World Book Encyclopedia*. World Book—Childcraft International, Inc., 1978.




# Introduction

Picture this:

It's early in the morning. You're asleep. Your alarm clock wakes you.

You wash your hair and then dry it with a hair dryer. You make some toast. The radio is on while you eat your breakfast.

You leave the house and head for the bus stop. You listen to your transistor radio until the bus comes. As you ride along, the traffic lights give their red, yellow, and green signals.

During the day, you buy some things. The store clerks use machines to ring up the sales. You make some phone calls.

At home that evening, you watch TV. A friend rings the doorbell. You turn on a lamp. You put your dinner in the oven. Later, you set your alarm clock. You turn out the light and go to bed.

All day long, you use electricity. You depend on it to wake you and to cook your food. You use it to play music, to go from place to place, and for many other things.

Electricity is an important part of your life. In this book, you'll learn how electricity works and how to use it safely.

Unit 1

# A Special Path

Did an electric alarm clock wake you today? Did you turn on a lamp? Use an electric hair dryer?

If you did, you used electricity. Electricity is a kind of energy that can make things work. But for electricity to make things work, it must have a special path that it can follow.

- What is that path called?
- What is that path like?

You'll learn the answers in this unit.

## Before You Start

You'll be using the science words below. Find out what they mean. Look them up in the Glossary that's at the back of this book. On the lines below, write what the words mean.

1. **battery** _____

_____

2. **flow** _____

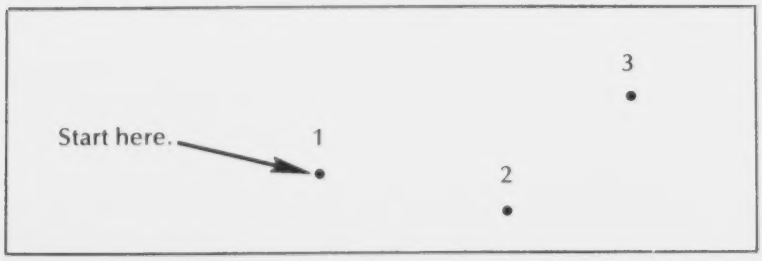
_____

## There and Back Again

*Click!* You turn on a lamp and the **bulb** lights up. Why does that happen?

The bulb lights up because electricity flows through it. For electricity to flow, it needs a special path to follow. That path is called a **circuit**.

What's a circuit like? Finish the diagram below and find out. Draw a line to connect all the dots to each other.




Imagine that the line you drew is like a wire that electricity flows through. You started at **1**. (**1** is like a place where electricity is made.)

You moved to **2** and then to **3**. (**2** and **3** are like a lamp.)

Where did you go from **3**?

---

Right! You went back to **1**. And that's what an electric circuit is like. It starts at a place where electricity is made. It goes *away* from that place. Then it goes *back* to that place.

The electricity you use every day is probably made at a place many miles from your home. It's made by a huge machine.

But electricity can also be made by other things. In fact, you may have one of those things in your home. You use it to make a flashlight work. What do you think it is?

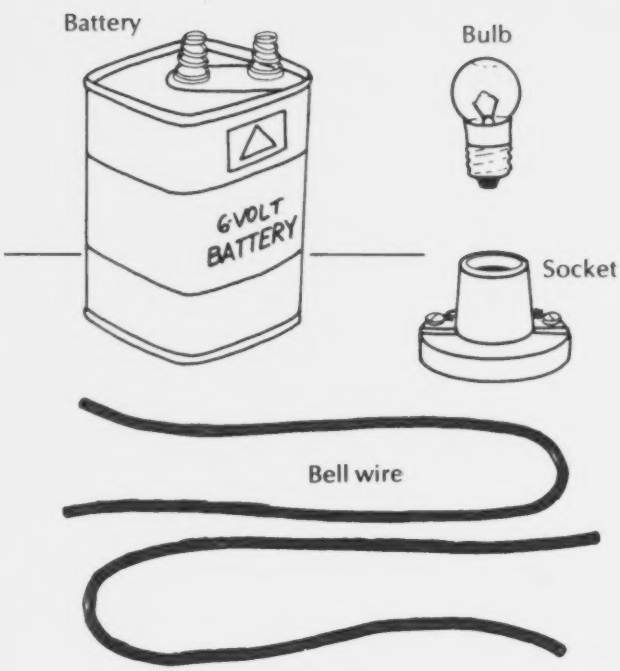
---

## Make a Circuit

You can make a circuit with things from a hardware store. The things are:

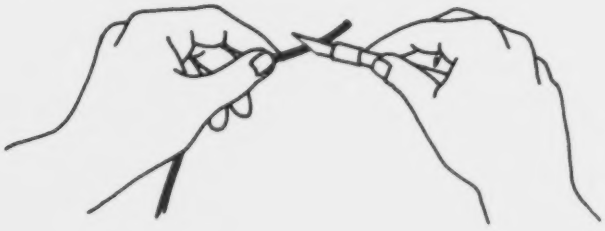
- 2 pieces of bell wire (each twelve inches long)
- 1 very small socket (with two **posts**)
- 1 six-volt battery (it has two posts)
- 1 small bulb that fits into the socket (like a flashlight bulb)

You'll also need a sharp knife. Put everything on a table. Then follow these directions.

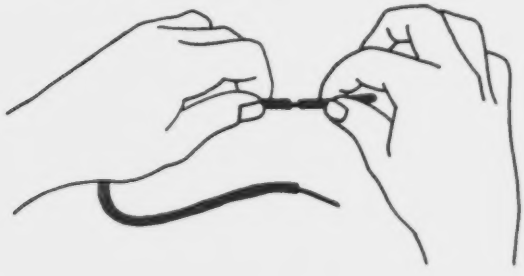



### 1

Strip the ends of each wire. First, carefully cut the covering one inch from the end. (Don't cut through the wire.) Cut all around the wire.



Pull the covering off the wire. The end will then be stripped.

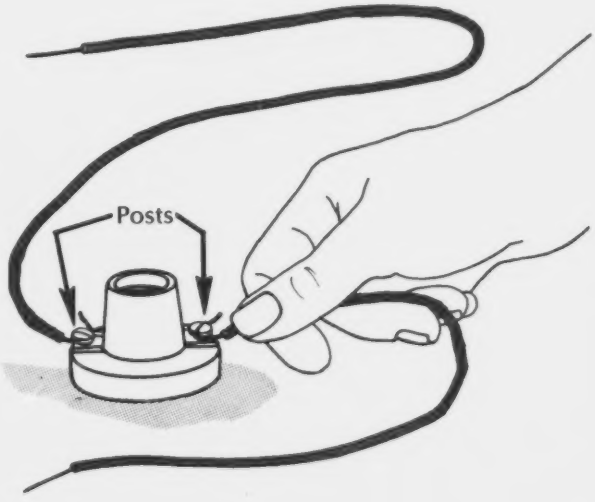


### 2

Get the socket.

Connect a stripped end of one wire to a post.

Connect a stripped end of the other wire to the other post.

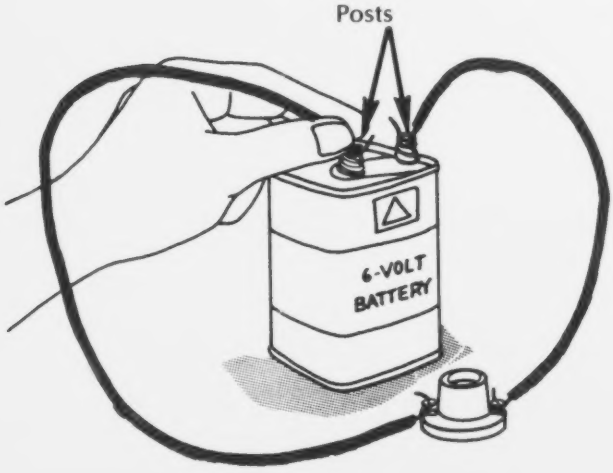


**3**

Get the battery.

Pick up one of the wires that's connected to the socket. Connect the stripped end of that wire to a post on the battery.

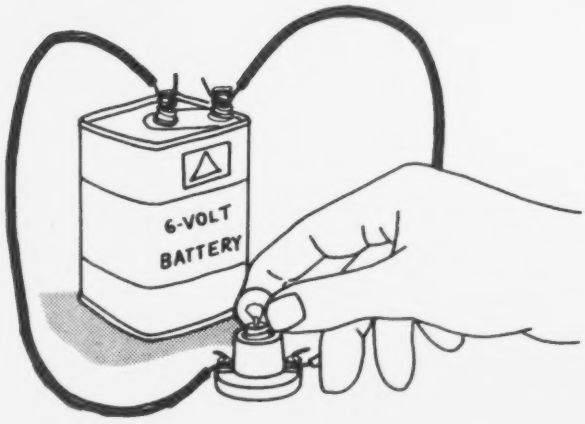
Connect the stripped end of the other wire to the other post on the battery.




**4**

Screw the bulb into the socket. You've just made a circuit.

Did the bulb light up? It should!




## What's Happening?

1. What makes electricity in your circuit?

   _____

   Yes, the battery makes electricity.

2. What makes a path for the electricity to follow?

   _____

   That's right. The wires make a path.

3. What happens to the bulb when electricity flows through your circuit?

   _____

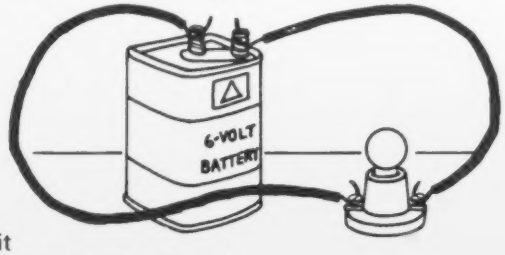
# Experiment 1
## What happens when you open a circuit?

You made a circuit with a bulb in it. The bulb lit up. It lit up because electricity flowed through it.

Electricity flowed because the circuit was closed. The circuit had no opening in it.

What happens if you open the circuit? Do the experiment and find out.

### Materials (What you need)




Your circuit
(set up so that the bulb is lit up)

---

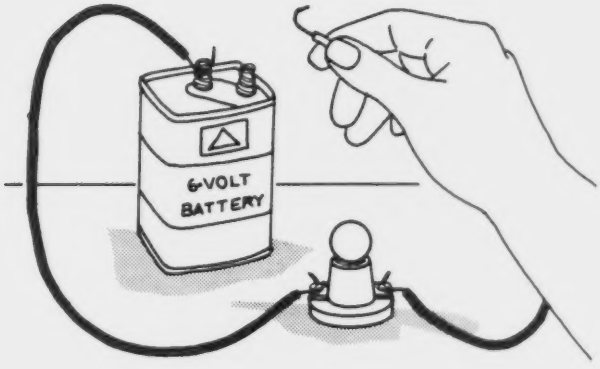
### Procedure (What you do)

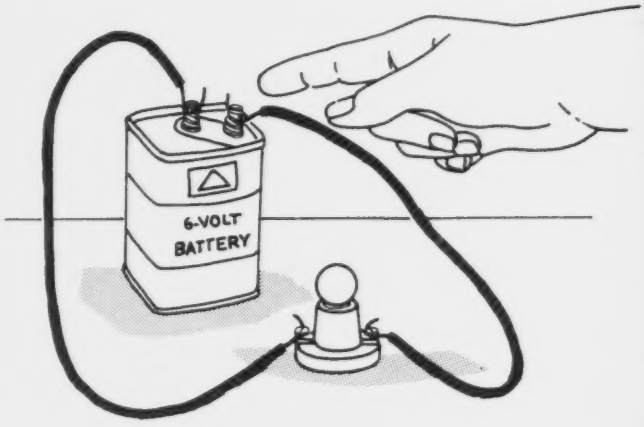
1. Open the circuit by doing this:
   Take the wire off one of the battery posts. What happens to the bulb?

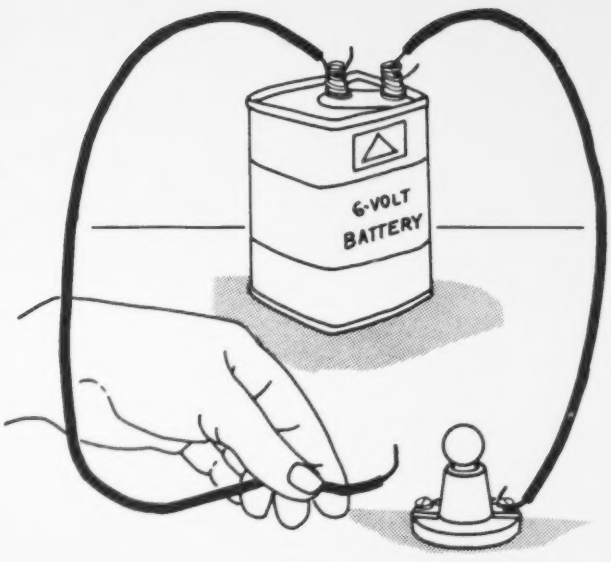
   _____

2. Close the circuit by doing this:
   Connect the wire to the battery post again. What happens to the bulb now?

   _____

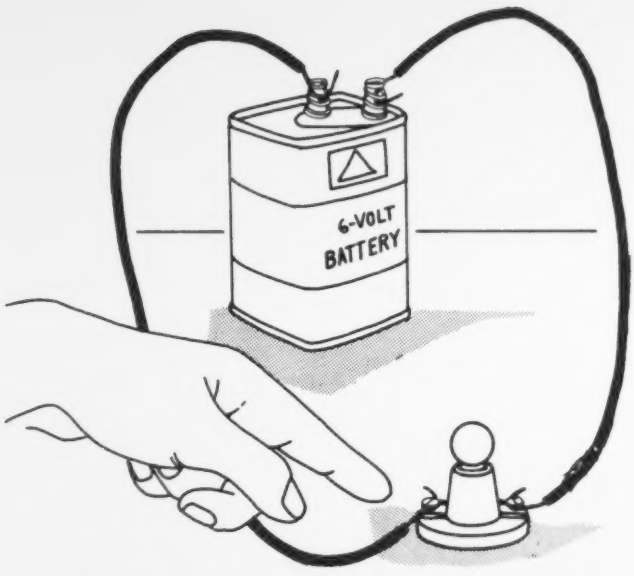





3. Open the circuit again. This time, take the wire off one of the socket posts. What happens to the bulb?

_____




4. Close the circuit. Connect the wire to the socket post again. Now what happens to the bulb?

_____

## Observations (What you see)

1. What happens to the bulb when you open the circuit?

_____

2. What happens to the bulb when you close the circuit?

_____

## Conclusion (What you learn)

What happens when you open a circuit? Does electricity flow or stop flowing? Finish this sentence.

Electricity _____.

## Check Yourself

Use words from this unit to do the crossword puzzle. The words you'll need are listed below. One is done for you.

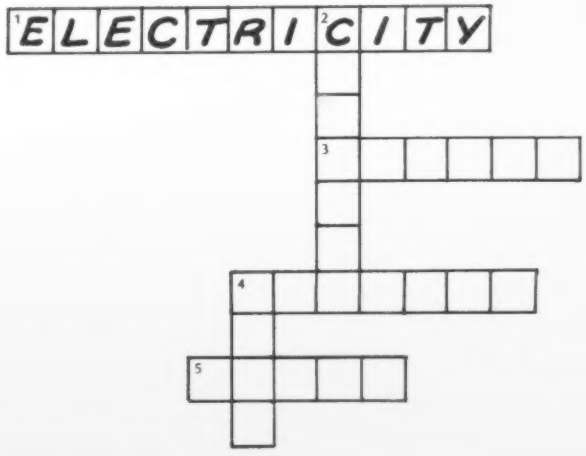
| | | |
|---|---|---|
| battery | electricity | bulb |
| circuit | closed | flows |

**Across**

1. A kind of energy
3. A circuit with no opening in it
4. Something that makes electricity
5. How electricity moves

**Down**

2. A path for electricity
4. Something that lights up




## Check These Out

1. On page 5, you read about "a huge machine" that makes electricity. That machine is called a generator. Find out how it works.
2. Find out how a battery makes electricity.
3. Make a list of the things in your home that run on batteries.
4. As you work through this book, you may want to find out more about electricity. You can find out more by looking in an encyclopedia or by getting books about electricity from a library. You can also talk to an expert, such as an electrician, an electrical engineer, or a clerk in a hardware store.

   Here are some things you may want to find out:

   - What are atoms? What are electrons?
   - What is static electricity? What is a positive charge? What is a negative charge?

Unit 2

# On and Off

Think about a lamp you use at home. Do you have to connect a wire each time you turn the lamp on? No, you just use the lamp switch. And you use the same thing to turn the lamp off.

- How does a switch turn a lamp on?
- How does a switch turn a lamp off?

You'll learn the answers in this unit.

## Before You Start

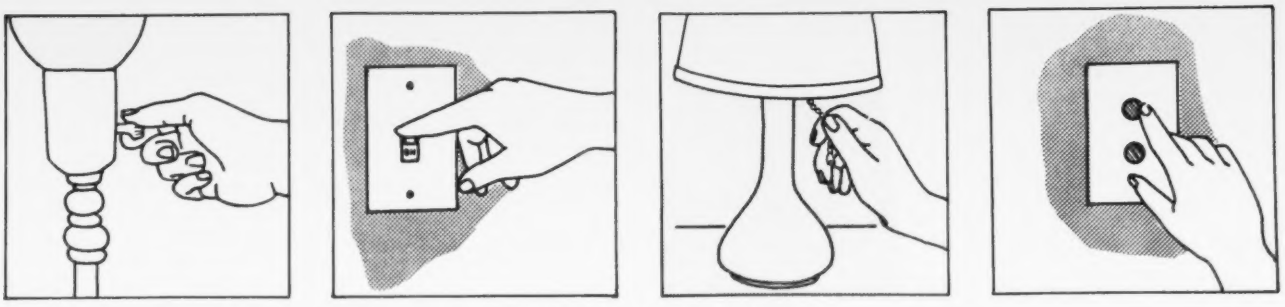
You'll be using the science words below. Find out what they mean. Look them up in the Glossary. On the lines below, write what the words mean.

1. **control** _____

_____

2. **switch** _____

_____



Different kinds of switches

## You're in Control

Can you control electricity? Sure! You do it every time you turn a lamp on or off. You do it by using the lamp switch.

A switch lets you control electricity without handling any wires. It lets you start and stop electricity that flows through things such as lamps, radios, and machines.

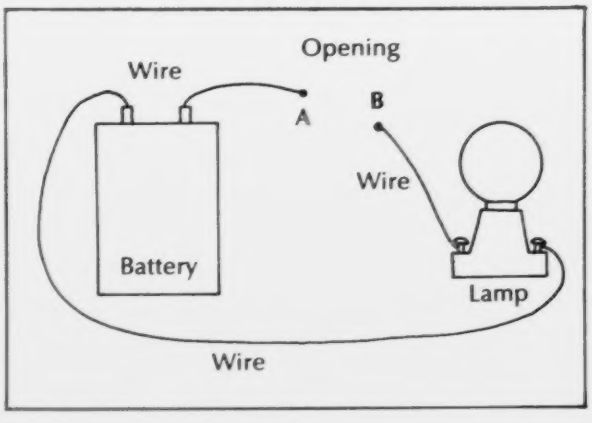
There are many kinds of switches. Some are buttons that you push. Others are chains that you pull. Still others are knobs that you turn. But all switches work the same way.

How does a switch work? Look at the diagram at the right. It shows an open circuit. Because the circuit is open, electricity can't flow. So the lamp (the bulb) is not on.

With a pencil, draw a line from **A** to **B**. You've just turned the lamp on! When you connect **A** to **B**, you close the circuit. Electricity starts flowing and the lamp goes on.

Now erase the line you drew. You've just opened the circuit. Electricity can't flow. Is the lamp on or off?

Diagram of an open circuit




---

Right! It's off.

That's how a switch works. It lets you close a circuit so that electricity can flow. And it lets you open the circuit when you want to stop electricity from flowing.

## Open or Closed?

The two diagrams on this page show how a switch opens and closes a circuit.

Write *closed* under the diagram that shows a switch closing a circuit.

Write *open* under the diagram that shows a switch opening a circuit.

Do the rest of this page.

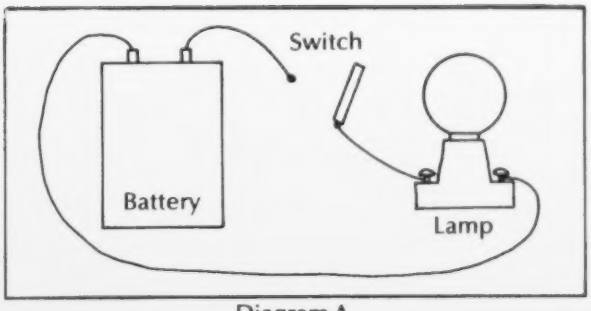



Diagram A

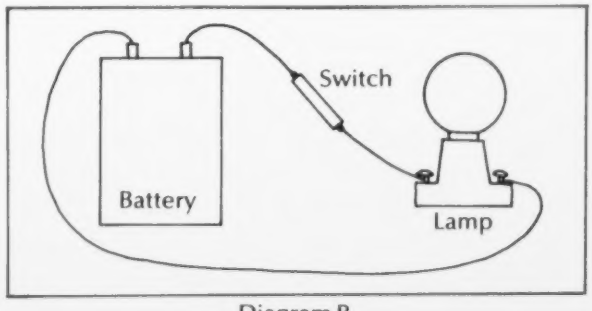



Diagram B

_____ _____

1. Look at Diagram **A**. Is the lamp on or off ?

   ☐ On ☐ Off

2. Look at Diagram **B**. Is the lamp on or off ?

   ☐ On ☐ Off

3. Now finish these sentences. Write *closes* or *opens*.

   a. When the switch _____ the circuit, electricity stops flowing and the lamp is off.

   b. When the switch _____ the circuit, electricity starts flowing and the lamp is on.

## Make a Switch

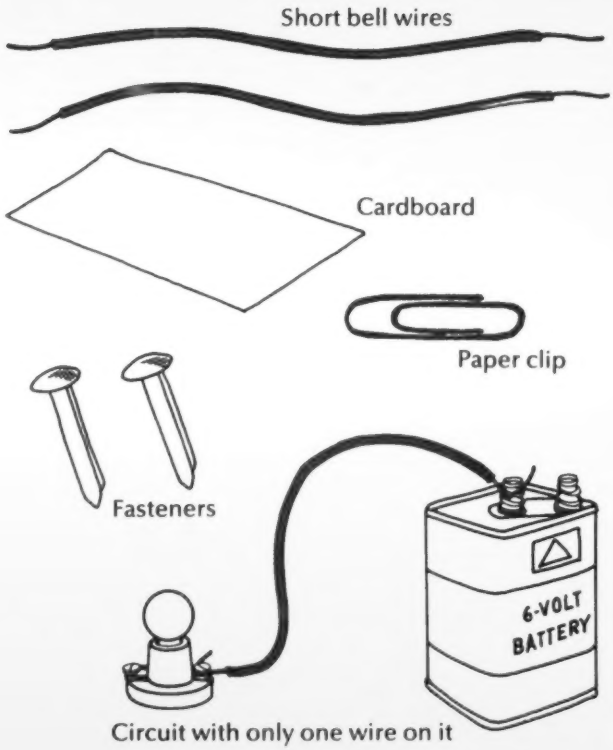
Here's an easy switch to make. You'll need:

- 1 piece of cardboard (about four inches long and two inches wide)
- 2 short pieces of bell wire (each six inches long)
- 2 one-inch brass fasteners
- 1 two-inch paper clip
- The circuit you made for unit 1 (with its battery)

Make sure the ends of the short wires are stripped. If they aren't, take off one inch of covering from each end.

Now take one of the wires out of your circuit. Take it out completely.

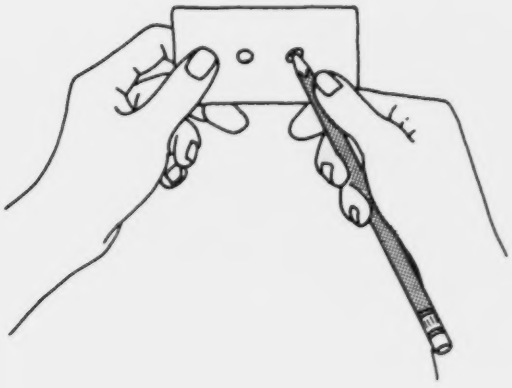
Make a switch for the circuit. Follow these directions.



Circuit with only one wire on it

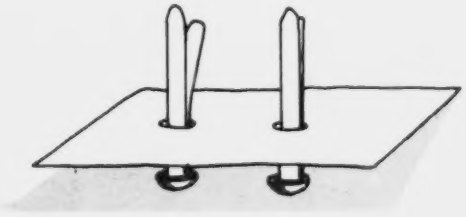
### 1

Make two holes in the cardboard. (Use a paper punch or poke out the holes with a pencil.) The holes should be about one inch apart.



### 2

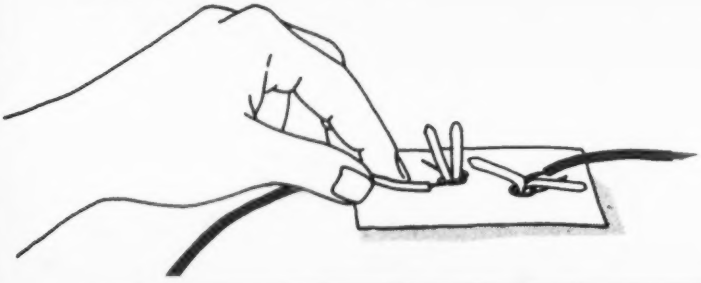
Push a fastener through a hole. Push the other fastener through the other hole.



**3**

Wrap one end of a short wire tightly around a fastener. (Make sure the stripped part touches the fastener.) Spread the fastener open.

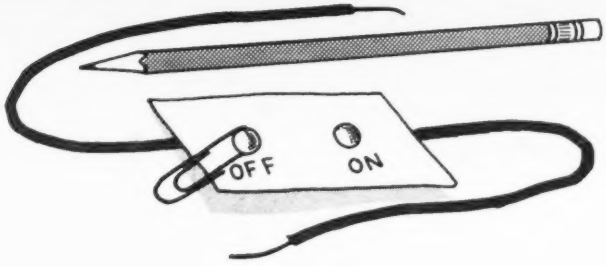
Do the same with the other wire and fastener.



**4**

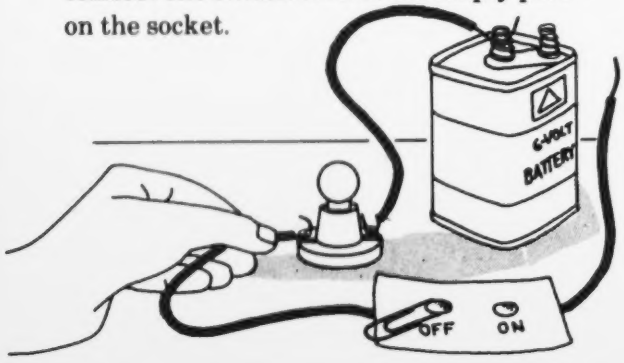
Turn the cardboard over. Hook the paper clip over the head of a fastener.

Write *OFF* near that fastener. Write *ON* near the other one.



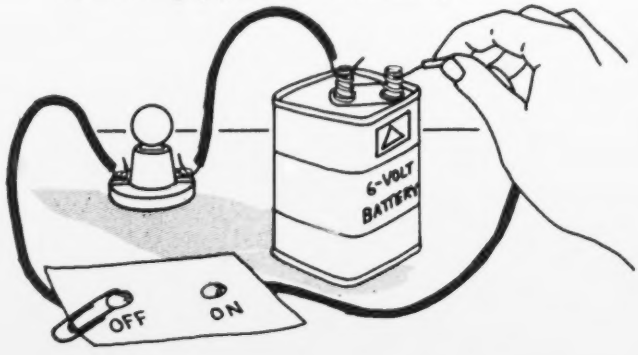

**5**

Now add the switch to the circuit. First, connect one switch wire to the empty post on the socket.



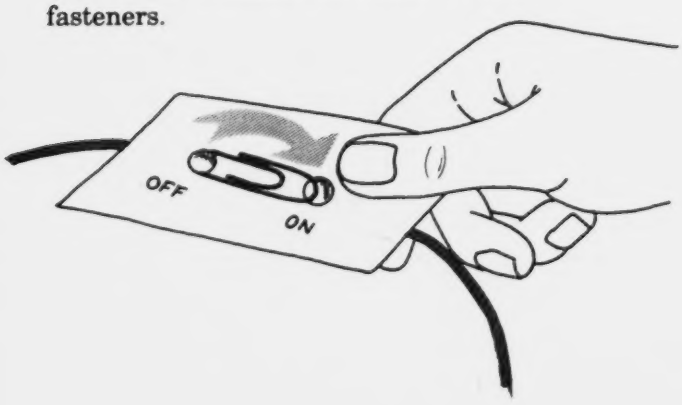

**6**

Then connect the other switch wire to the empty post on the battery.



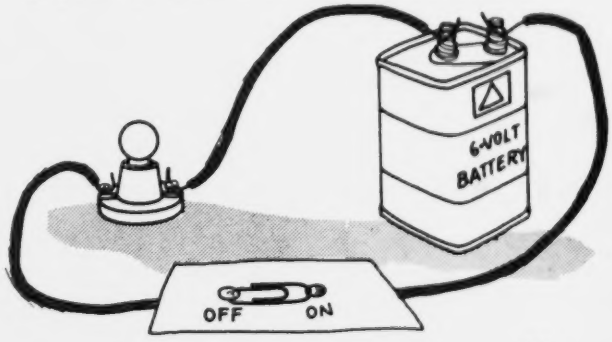

**7**

Turn the switch on. Move the paper clip so that it touches the heads of both fasteners.




**8**

Does the bulb light up? (If it doesn't, check the wires, the fasteners, and the paper clip. Make sure they're all touching.)



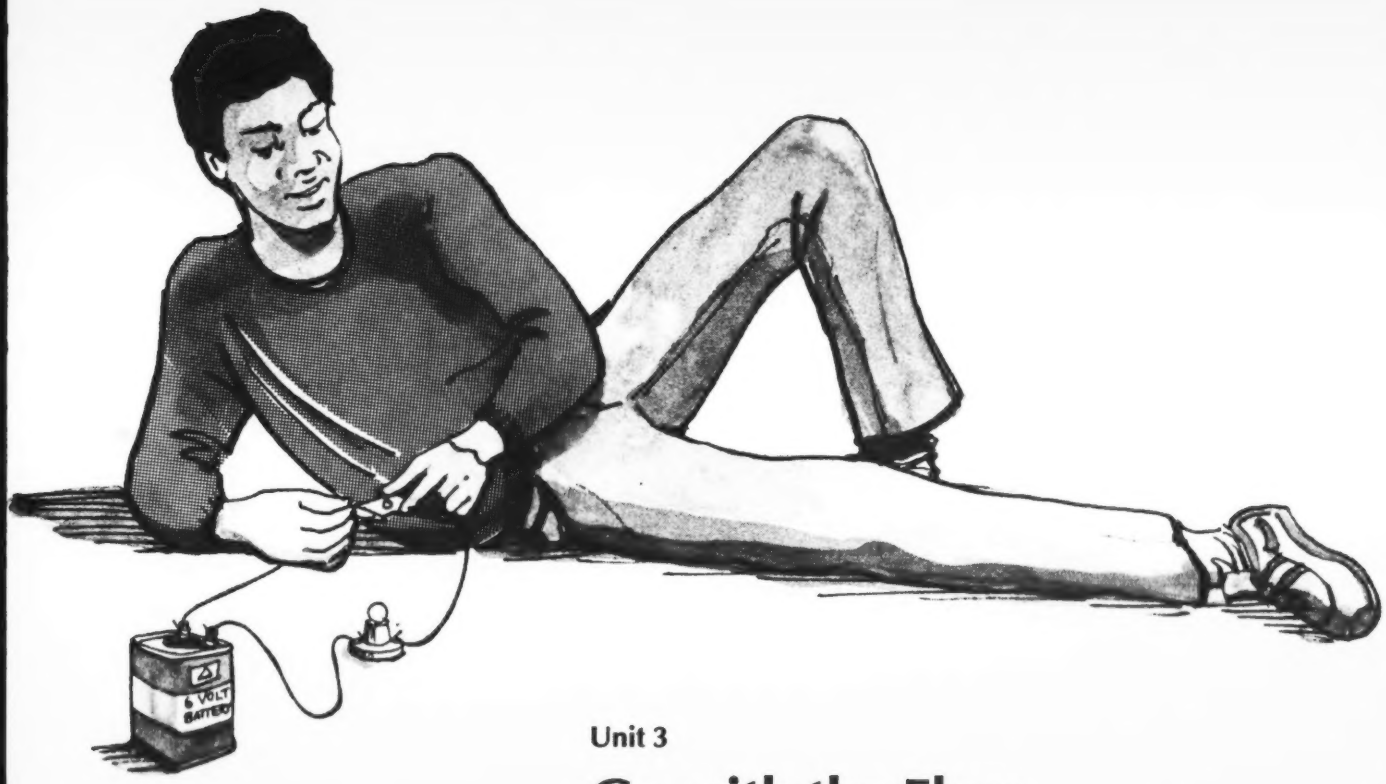
## Check Yourself

Show what you learned in this unit. Finish these sentences. Draw a line from the words on the left to the correct words on the right.

| | |
|---|---|
| 1. You can use a switch | a. closes a circuit. |
| 2. A switch opens or | b. an open circuit. |
| 3. Electricity flows through | c. to control electricity. |
| 4. Electricity can't flow through | d. a closed circuit. |

## Check These Out

1. Look around at home to see how many kinds of switches you can find. Draw a picture of each kind.
2. Get a wall switch. It can be a used one or a new one from a hardware store. Show the switch to the class. Explain how its parts work.
3. Here are some things you may want to find out:
   - What is current electricity?
   - What is voltage?
   - What is a transformer?




Unit 3

# Go with the Flow

You've seen that electricity flows through the wires in your circuit. And you've seen that it flows through the paper clip in your switch.

But electricity *can't* flow through some things.

- What things can electricity flow through?
- What things can't it flow through?

You'll learn the answers in this unit.

## Before You Start

You'll be using the science words below. Find out what they mean. Look them up in the Glossary. On the lines below, write what the words mean.

1. **conduct** _____

_____

2. **shock** _____

_____

## Cover Story

Look at a piece of bell wire. It has two parts — a wire center and a covering. Which part conducts electricity?

_____

The wire center conducts electricity. In other words, electricity flows through it.

The center is made of metal. Metal conducts electricity. Anything that conducts electricity is a **conductor**. So metal is a conductor.

Anything that electricity *can't* flow through is a **nonconductor**. For example, look at the covering of the bell wire. It's made of something that doesn't conduct electricity. What is the covering made of?

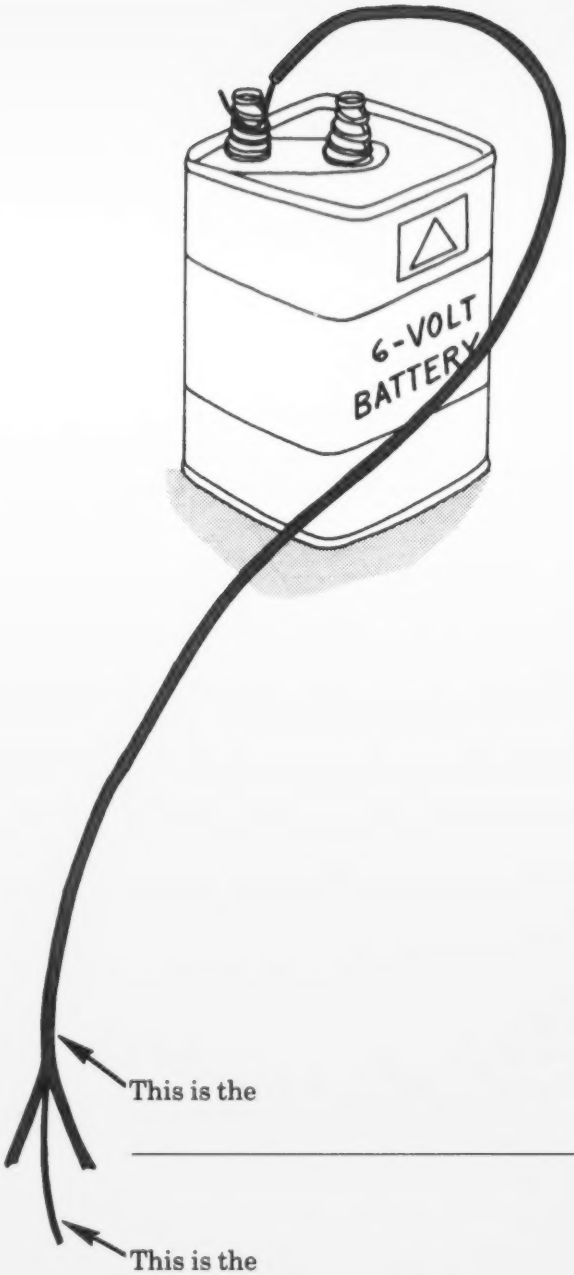
_____

What do you think could happen if the wire had no covering?

_____

If the wire had no covering, electricity could flow out of the wire. It could flow into any conductor that touched the wire. For example, if *you* touched the wire, electricity could flow into you. You could get a shock.

Now look at the picture on this page. Write *conductor* next to the part of the wire that conducts electricity. Write *nonconductor* next to the part that doesn't conduct electricity.




This is the _____.

This is the _____.

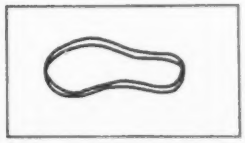
## Which Is Which?

The pictures on this page show things you use every day. Guess which things can conduct electricity. Guess which ones can't.

Write *conductor* next to the things you think can conduct electricity.

Write *nonconductor* next to the things that can't conduct electricity.

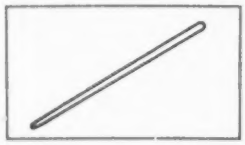
1. Metal penny _____



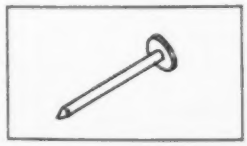
2. Rubber band _____

3. Glass _____

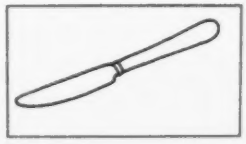
4. Metal key _____



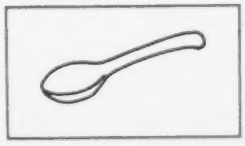
5. Wood toothpick _____



6. Metal nail _____



7. Metal knife _____



8. Plastic spoon _____

Find out if your guesses are correct. Turn the page and do the experiment.

## Experiment 2
## Which things are conductors?

### Materials

Metal penny

Metal key

Plastic spoon

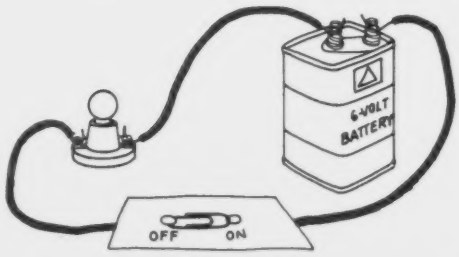
Rubber band

Wood toothpick

Metal nail

Glass

Metal knife



Your circuit and battery

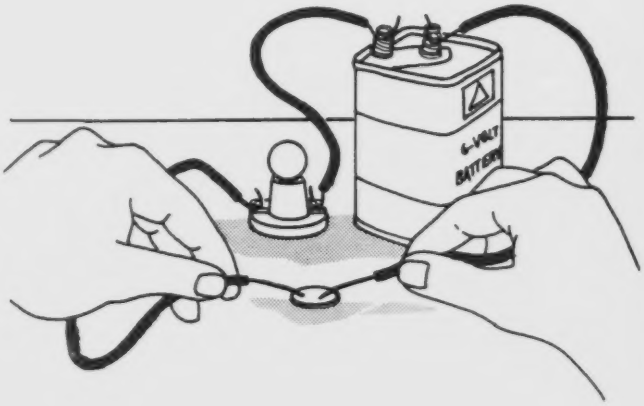
### Procedure

1. Put everything on a table in front of you. If your circuit has a switch, unwrap the wires on the switch fasteners. Then take the switch off the circuit.

2. Get the penny. Pick up the two loose wires on the circuit. Touch the penny with the stripped ends of the two wires.

   Does the bulb light up? If it does, the penny is a conductor.

   Test the rest of the things in the same way. After you test each thing, write about it on the next page.



## Observations

Write the name of each thing in one of these lists. Then write what the thing is made of. The first is done.

| 1. This lights up the bulb: | What it's made of: |
|---|---|
| penny | metal |
| | |
| | |
| | |

| 2. This doesn't light up the bulb: | What it's made of: |
|---|---|
| | |
| | |
| | |
| | |

## Conclusions

Finish these sentences. Draw a circle around the right words.

1. Electricity can flow through _____.

   rubber metal glass plastic wood

2. Electricity can't flow through _____.

   rubber metal glass plastic wood

3. The things made of _____ are conductors.

   rubber metal glass plastic wood

## How did you do?

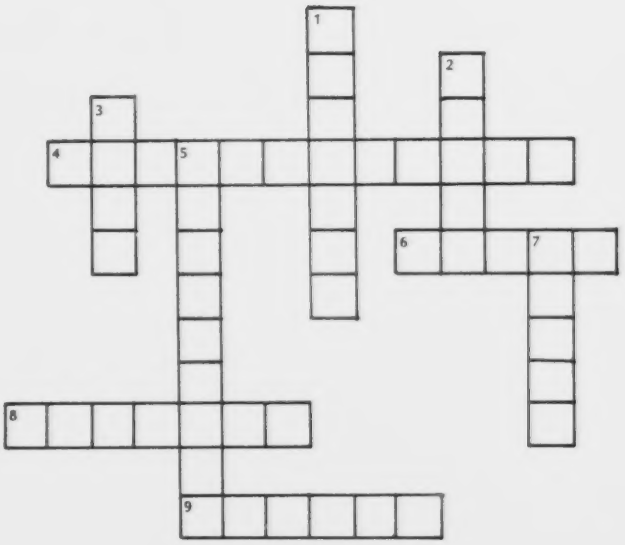
**Turn back to page 19. Did you say these things are conductors? *Penny, key, nail, knife.***

**Did you say these things are nonconductors? *Rubber band, glass, toothpick, spoon.***

## Check Yourself

Use words from this unit to do the crossword puzzle. The words you'll need are listed below.

| | | |
|---|---|---|
| conductor | nonconductor | shock |
| conduct | metal | plastic |
| rubber | glass | wood |




**Across**

4. Something that can't carry electricity
6. A nonconductor that windows are made of
8. A nonconductor that's used to cover wire
9. A nonconductor that tires are made of

**Down**

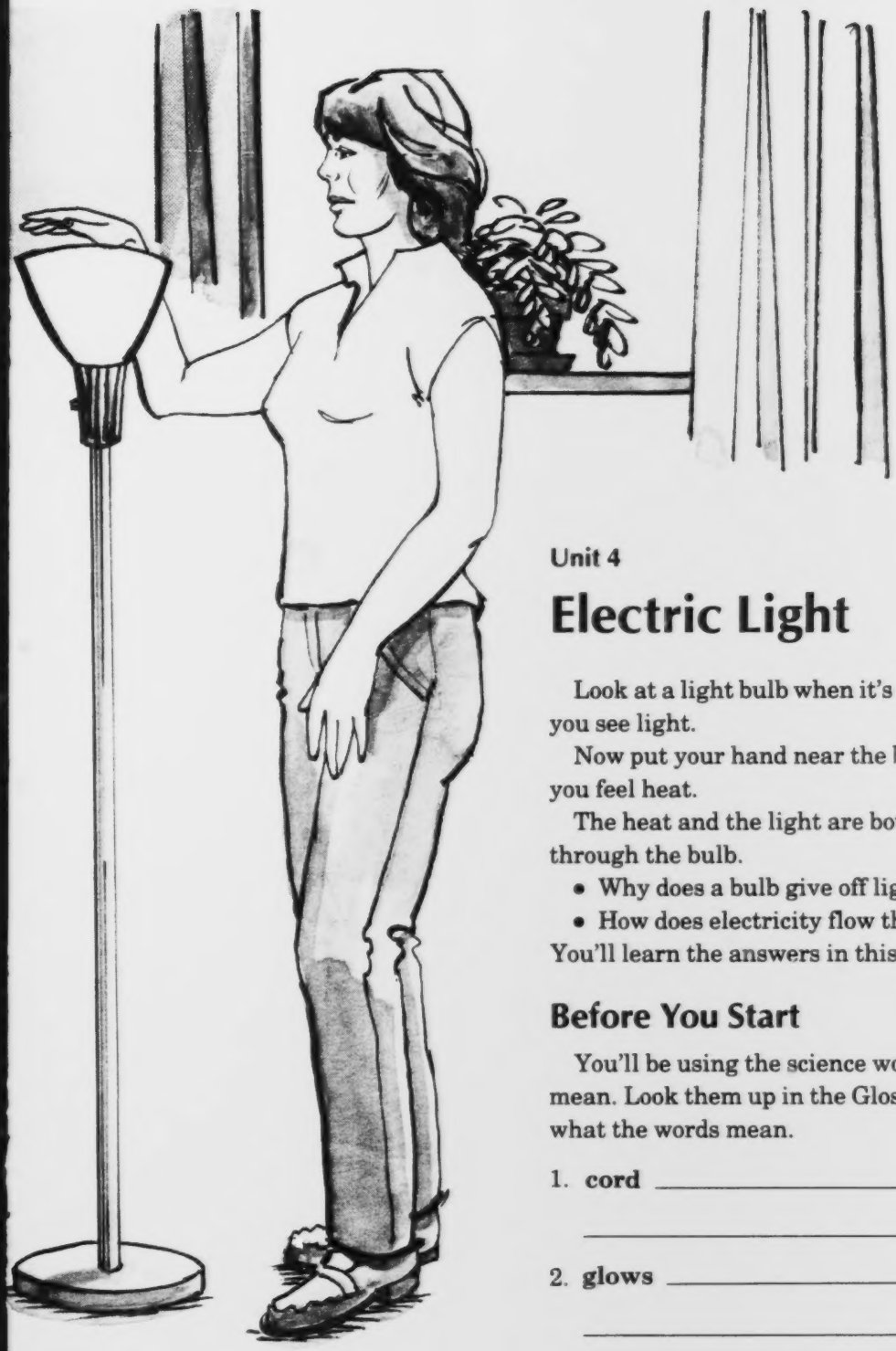
1. Carry something
2. A conductor
3. A nonconductor that some chairs are made of
5. Something that carries electricity
7. A pain that electricity can cause

## Check These Out

1. Look around your home. Find three things that are conductors and three things that are nonconductors. Bring them to class. Ask the class to tell which things are conductors and which are nonconductors.

2. Go to a hardware store and look at different kinds of electrical wires. Ask a salesperson these questions about the wires:
   - What different kinds of metals are used in the wires?
   - What different kinds of materials are used as coverings for the wires?

3. Here are some things you may want to find out:
   - What is an insulator?
   - What are free electrons?
   - Why do metals make good conductors?



Unit 4

# Electric Light

Look at a light bulb when it's on. What do you see? Of course, you see light.

Now put your hand near the bulb. What do you feel? Yes, you feel heat.

The heat and the light are both made by electricity flowing through the bulb.

- Why does a bulb give off light?
- How does electricity flow through a bulb?

You'll learn the answers in this unit.

## Before You Start

You'll be using the science words below. Find out what they mean. Look them up in the Glossary. On the lines below, write what the words mean.

1. **cord** _____

_____

2. **glows** _____

_____

3. **incandescent** _____

_____

## It's So Hot, It Glows

Look at the light bulb in your circuit. What's inside the light bulb?

_____

Right. A very thin wire.

Now set up the circuit so that the light bulb is on. What part of the bulb glows?

_____

Right again. The thin wire inside the bulb is the part that glows.

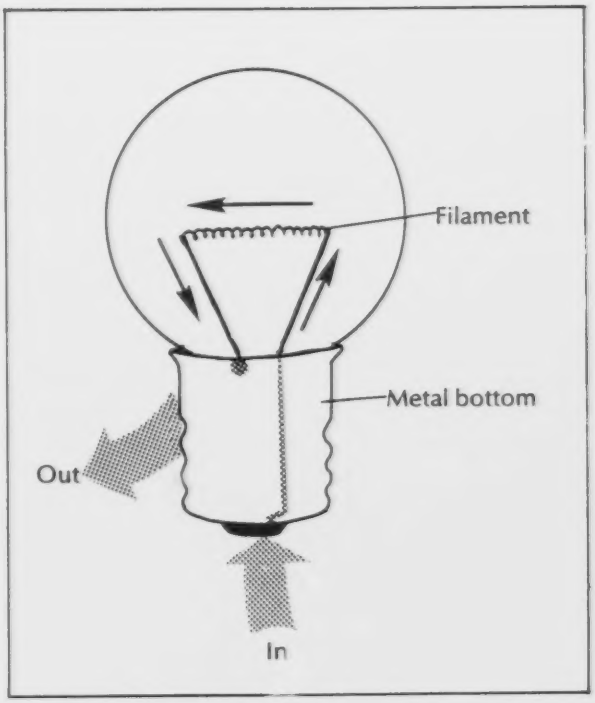
That wire is called a **filament**. The filament is made of a special metal that can be heated quickly and easily. When the metal is heated, it glows. In other words, it gives off heat and light.

Light bulbs that have a filament are called incandescent light bulbs. Most of the bulbs you use every day are incandescent bulbs. Incandescent bulbs are used in lamps and flashlights. They are used in cars, on Christmas trees, with cameras, and so on.

Incandescent light bulbs come in many shapes and sizes. But they all work the same way. They all have a filament that glows when electricity flows through it.

Look at the diagram at the right. It shows how electricity flows through a light bulb. The electricity goes into the metal bottom of the bulb. It flows through the filament. Where does it come out again?

_____




How electricity flows through a bulb

## Back to the Circuit

What heats the filament in a light bulb? Electricity does.

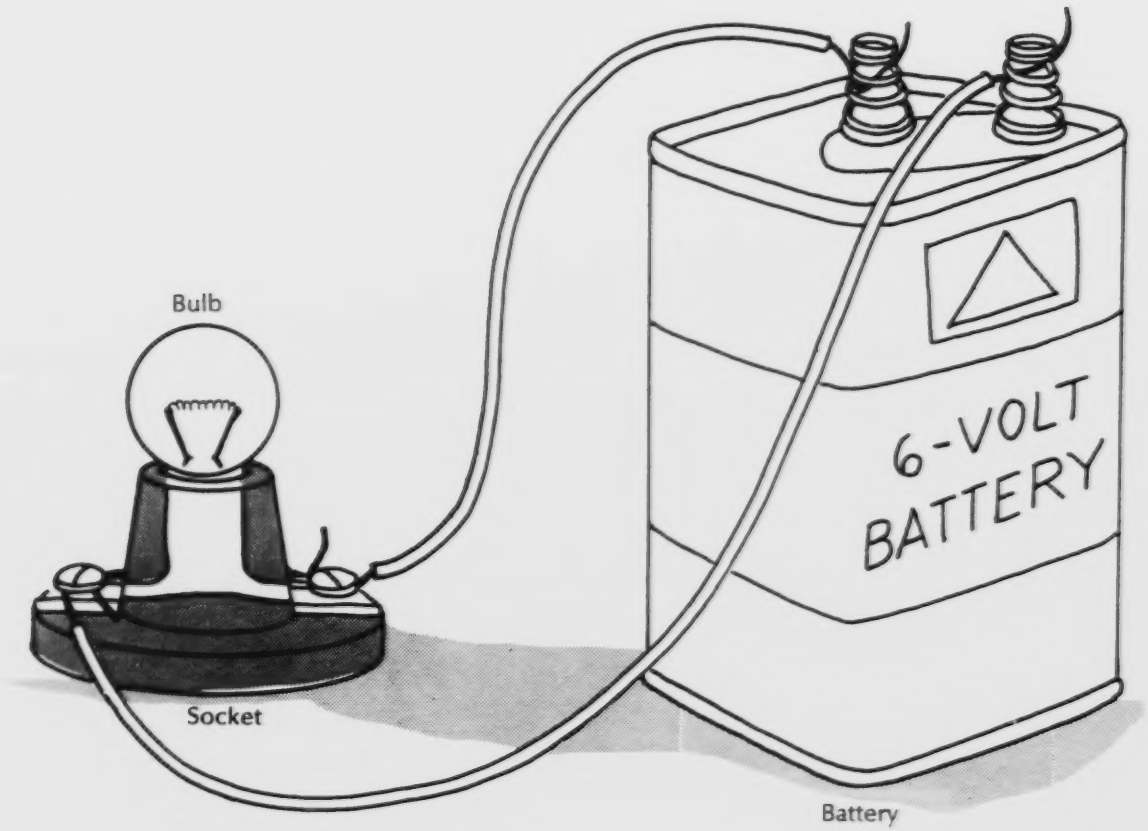
How does electricity get to and from the light bulb? You already know these things:

- Electricity follows a path.
- That path is made of something that is a conductor.
- Metal is a conductor.

So you know that electricity gets to and from the light bulb by following a metal path.

Think about the circuit you made. You connected two metal wires to the metal posts on a battery. And you also connected those two wires to the metal posts on a socket. Then you added a bulb that has a metal bottom and a metal filament. You made a metal path for electricity to follow.

The picture below shows a circuit like yours. Get a colored pencil. Draw a line in the picture to show the metal path that goes to and from the bulb.



## Two-Way Traffic

Think of a lamp like the one in the picture. What conducts electricity to and from the lamp?

_____

Right! The lamp cord.
How many wires do you think the cord has?

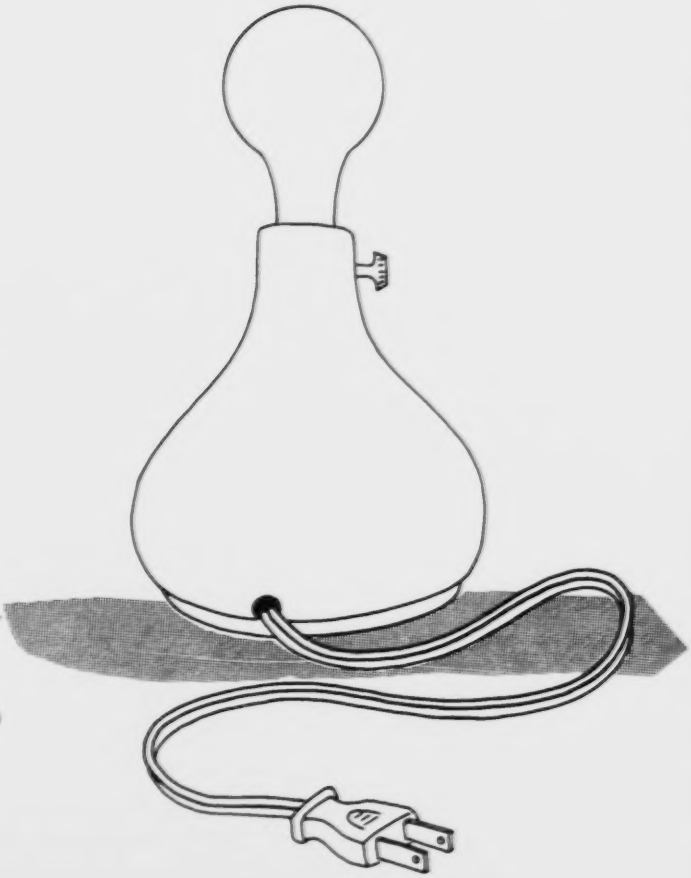
_____

It looks as if it has only one wire. But it really has two. If you look closely at the cord, you'll see this: It's made up of two covered wires that are stuck together.

The two cord wires work just like the wires in your circuit. One cord wire conducts electricity one way — to the lamp. The other cord wire conducts electricity the other way — from the lamp.

With your circuit, you can see how a cord works. You'll need:

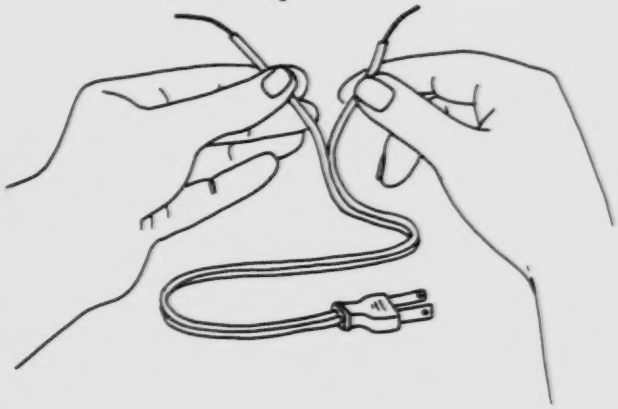
- 1 cord with a plug on it (from a hardware store)
- Your circuit with its switch and battery



Warning! This activity should be done with a battery only. *Do not plug this circuit into a wall outlet!* (The electricity from an outlet is too powerful.)

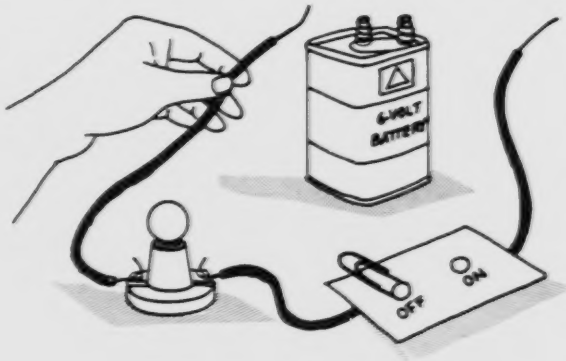
**1**

Get the lamp cord. Pull the two wires apart for a few inches. Strip the end of each wire. Then the cord should look like the picture.



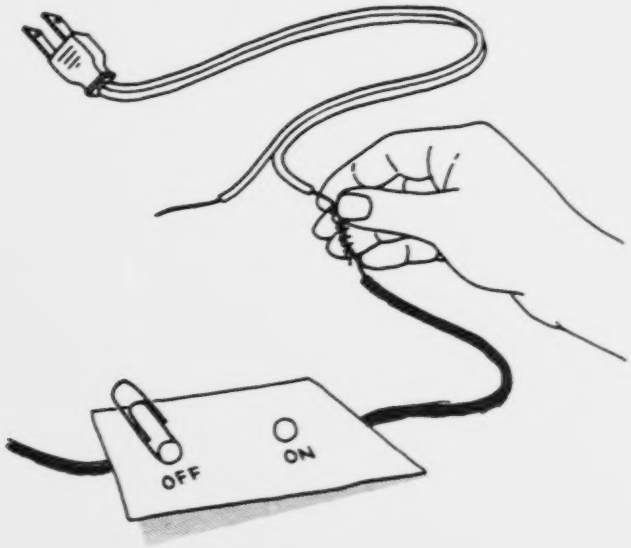
**2**

Get your circuit. Take both wires off the battery posts.



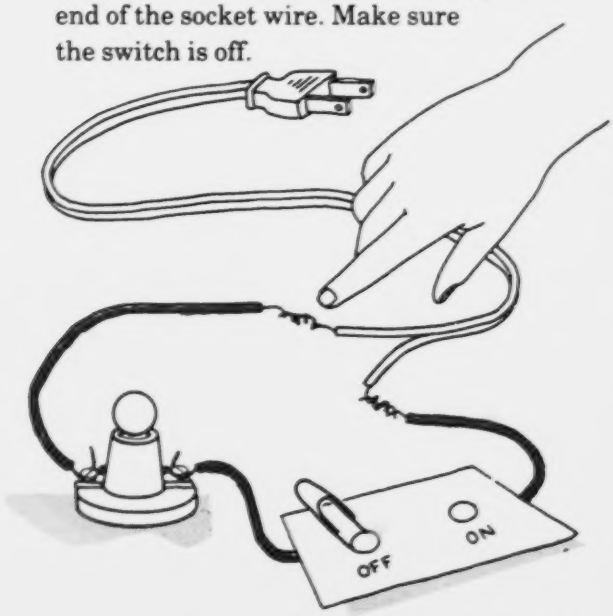
**3**

Pick up the stripped end of a cord wire. Twist it around the stripped end of the switch wire.



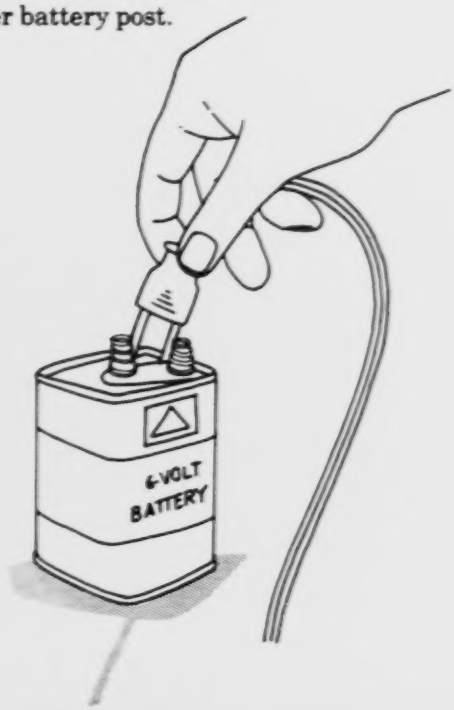

**4**

Pick up the stripped end of the other cord wire. Twist it around the stripped end of the socket wire. Make sure the switch is off.




**5**

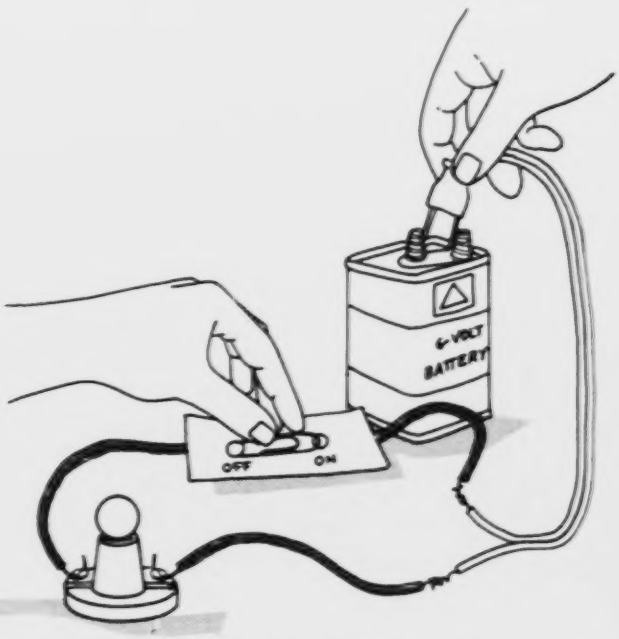
Pick up the plug. Press one metal part tightly against one of the battery posts. Press the other metal part tightly against the other battery post.




**6**

Turn the switch on. What happens?

_____




**Warning:** Don't fool around with electricity. It can hurt you!
*Do not plug this circuit into a wall outlet.*

## Check Yourself

Show what you learned in this unit. Finish these sentences. The words you'll need are listed below. (You'll use one of the words twice.)

metal filament incandescent

cord glows

1. The thin wire in a light bulb is called a _____ .
2. The filament is made of a special _____ .
3. When the filament gets very hot, it _____ .
4. An _____ bulb is a light bulb that has a filament.
5. There are two wires in an electric _____ .
6. Electricity follows a _____ path.

## Check These Out

1. You know that light can be made by a filament that glows. But some kinds of light are not made by a filament. One of these kinds of light is called *fluorescent* light. Find out how it is made.
2. Another kind of light that is not made by a filament is called *neon* light. Find out how it is made.
3. Find out how a toaster works. (Hint: It works something like a light bulb.)
4. Here are some more things you may want to find out:
   - Who was Georg S. Ohm? What did he discover about current electricity?
   - What is an ohm?
   - What is resistance?
   - Some conductors have more resistance than others. Why?
   - How is resistance used in appliances that make heat, such as toasters?

Unit 5

# Hot Wires

Your circuit with its battery gives only a small amount of electricity. But that's enough to light a small bulb.

There are circuits in your house too. A house circuit gives a lot more electricity than a battery circuit. It gives so much electricity that it can become dangerous.

- How can a circuit become dangerous?
- What keeps a circuit safe?

You'll learn the answers in this unit.

## Before You Start

You'll be using the science words below. Find out what they mean. Look them up in the Glossary. On the lines below, write what the words mean.

1. **appliance** _____

_____

2. **outlet** _____

_____

## A Lot of Electricity

How do you connect a lamp or a toaster to a circuit in your house?

---

Right. You plug the lamp or toaster cord into a wall outlet. The wall outlet is part of the house circuit. That circuit can give a lot of electricity. How much can it give? That depends on what's plugged into the circuit.

Suppose you plug a toaster into an outlet and turn the toaster on. A lot of electricity flows through the circuit. A toaster needs a lot of electricity.

But suppose you plug a lamp into an outlet and turn the lamp on. Less electricity flows through the circuit. A lamp doesn't need as much electricity as a toaster.

Why do you think a toaster needs a lot of electricity? Get a toaster and find out.

Look inside the toaster. What do you see?

---

Did you say, "Lots of wires"?

Now plug in the toaster and turn it on. What happens to the wires?

---

They get very hot — hot enough to toast bread. It takes a lot of energy to heat all those wires. That's why a toaster needs a lot of electricity.

## Danger! Overload!

You've seen that a toaster needs a lot of electricity to make heat. There are other appliances that make heat. And those appliances need large amounts of electricity too. What are some of those appliances?

_____

_____

_____

_____

Suppose you plug two or three of those appliances into an outlet and turn them all on. What happens in the circuit?

_____

Right! Lots and lots of electricity flows. The more appliances you use at the same time, the more electricity flows.

If you use too many appliances on one circuit, the circuit wires will be **overloaded**. The wires will carry more electricity than they can safely handle.

Look at the picture above. It shows many appliances plugged into one outlet. If those appliances are all turned on at the same time, the circuit will be overloaded.

What could you do to make sure the circuit isn't overloaded?

_____

That's right. Don't plug so many appliances into one outlet.

## Keeping It Safe

Suppose you overload a circuit by mistake. You use your iron, coffeepot, and electric stove, all at the same time. A lot of electricity flows. The circuit wires get warm . . . warmer . . . hot! They could start a fire!

Suddenly the stove, the toaster, and the iron go off. What happened?

---

Something stopped the electricity before the wires got too hot. It kept the circuit safe.

What stopped the electricity was a **fuse**. A fuse is like a switch. It can open a circuit.

The picture on the next page shows one kind of fuse. The fuse has a metal bottom, like a light bulb. That bottom fits into something like a socket. The fuse has a glass top. The top covers a thin strip of metal.

If too much electricity flows through the fuse, the strip melts. What does that do to the circuit?

---

Right! It opens the circuit.

What happens when the circuit is opened?

---

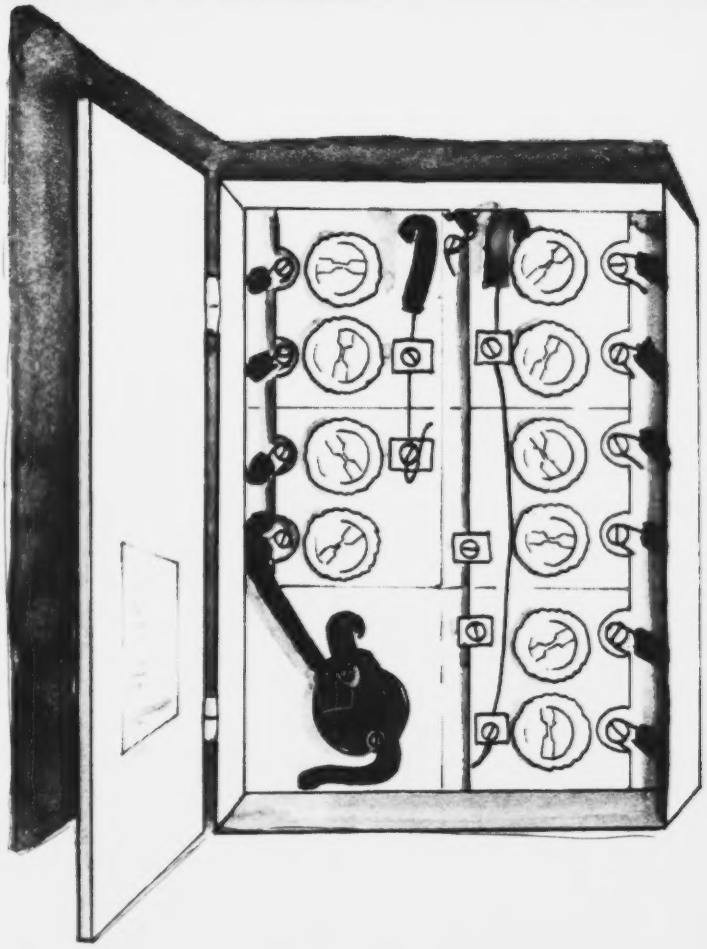
Yes, the electricity stops flowing. The circuit wires cool off. And the circuit is safe.

Each circuit in a house has a fuse. All the fuses are in a **fuse box**. (Your house may have **circuit breakers** instead of fuses. They work the same way.)

Where can you find the fuse box (or circuit breakers) in your house?

---

---



## Flowing through a Fuse

Get a fuse. (You can find one in a hardware store.) Look at the fuse. Do you see the metal bottom? The thin metal strip? Those are the two most important parts of the fuse.

Electricity flows through a fuse the same way it flows through a light bulb. It follows a metal path.

What part of a fuse does electricity go into first?

_____

Right! Electricity goes into the metal bottom.

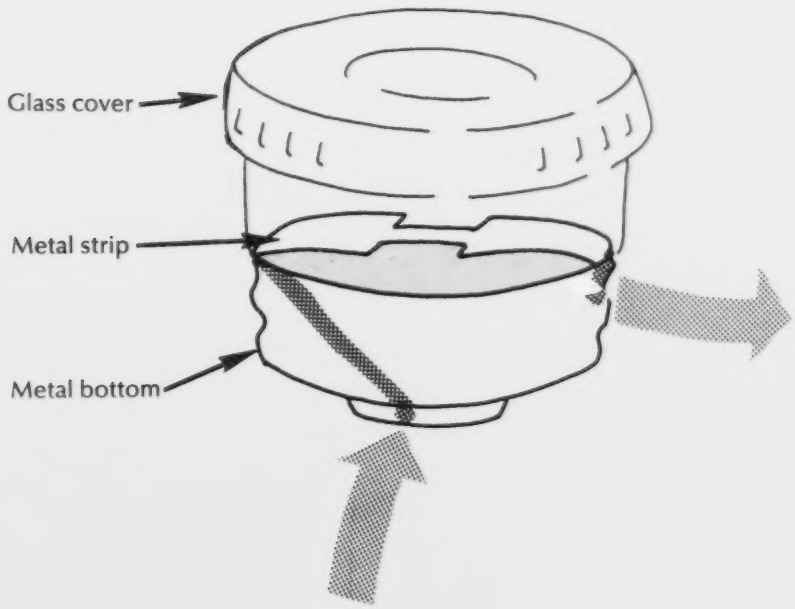
What part of a fuse does electricity then flow through?

_____

What part of a fuse does electricity come out of?

_____

Get a colored pencil. Look at the picture of the fuse on this page. Draw a line in the picture to show the path of electricity in a fuse. Write *IN* where electricity goes into the fuse. Write *OUT* where electricity comes out.



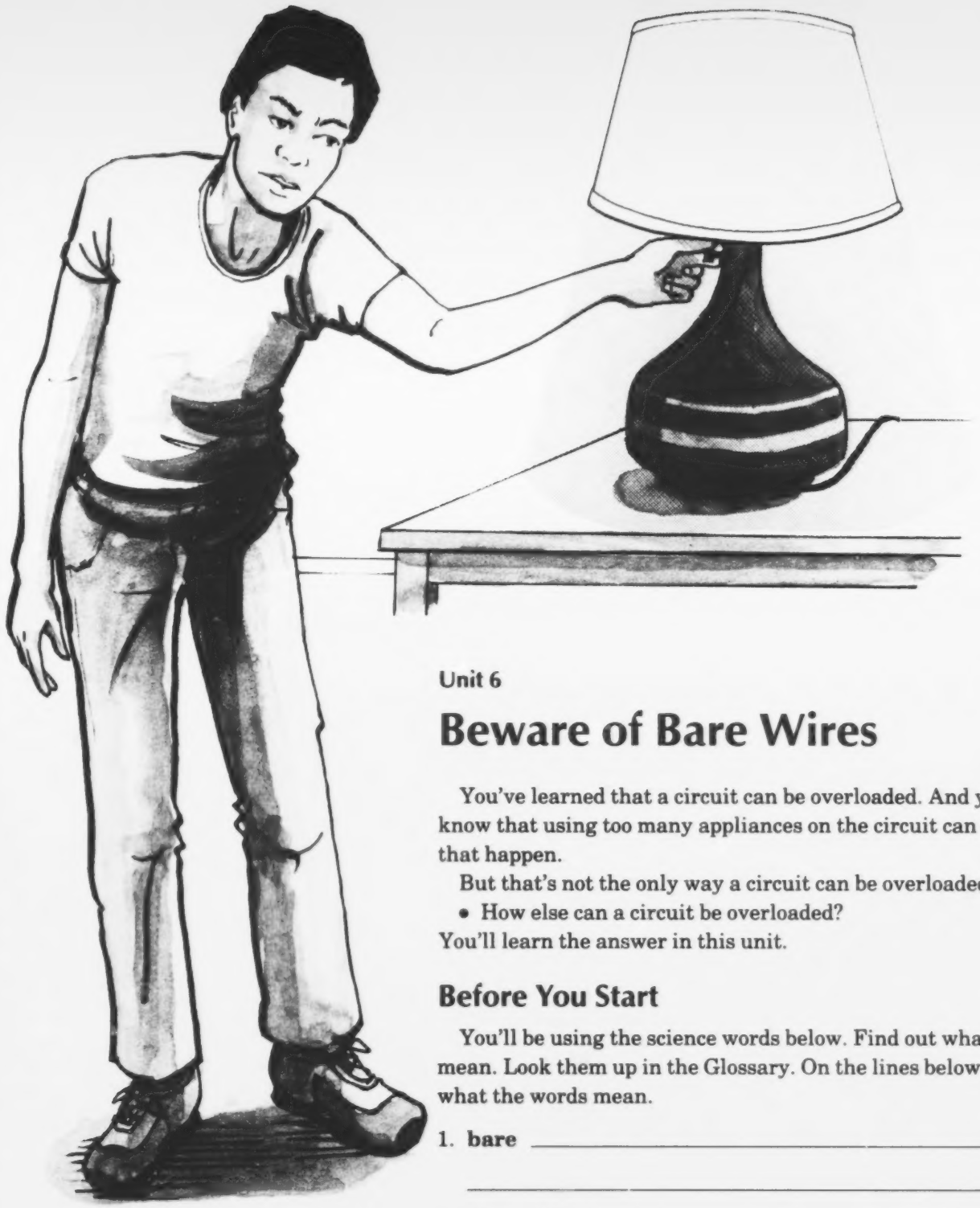
## Check Yourself

Show what you learned in this unit. Finish these sentences. Draw a line from the words on the left to the correct words on the right.

| | |
|---|---|
| 1. Appliances that make heat need | a. and keep it safe. |
| 2. A fuse can open a circuit | b. start a fire. |
| 3. The strip in a fuse melts if | c. large amounts of electricity. |
| 4. An overloaded circuit can | d. too much electricity flows through it. |

## Check These Out

1. Find out how many circuits there are in your house. Count the fuses in the fuse box. Or ask someone. Compare what you find out with what others in the class find out.
2. When the thin strip in a fuse melts, the fuse must be replaced. Find out how to replace a fuse safely.
3. How does a circuit breaker work? Find out and explain to the class.
4. Here are more things you may want to find out:
   - What is an ampere? What is a watt?
   - What is direct current? What is alternating current?
   - How does an electric motor work?



Unit 6

# Beware of Bare Wires

You've learned that a circuit can be overloaded. And you know that using too many appliances on the circuit can make that happen.

But that's not the only way a circuit can be overloaded.

- How else can a circuit be overloaded?

You'll learn the answer in this unit.

## Before You Start

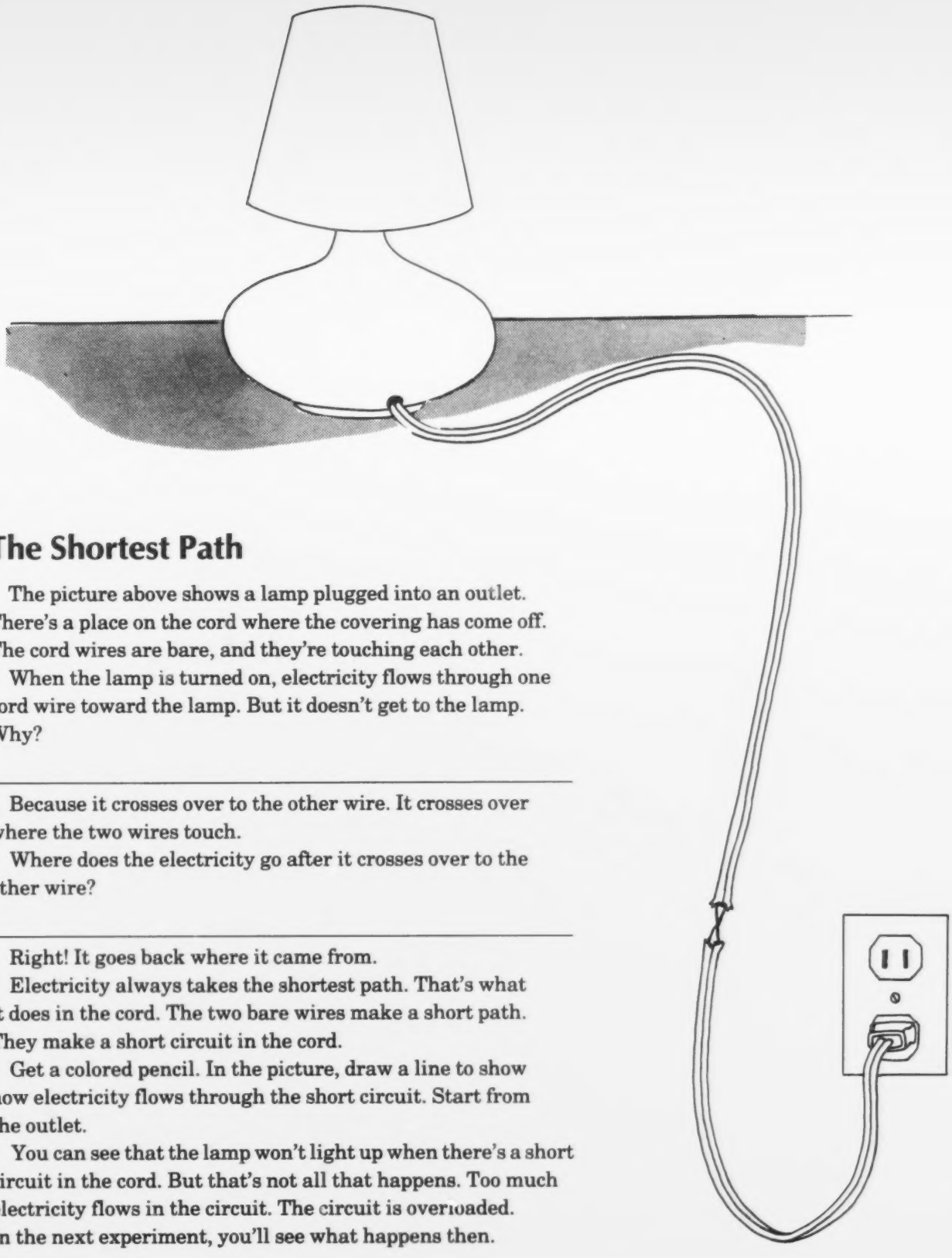
You'll be using the science words below. Find out what they mean. Look them up in the Glossary. On the lines below, write what the words mean.

1. **bare** _____

_____

2. **short circuit** _____

_____



## The Shortest Path

The picture above shows a lamp plugged into an outlet. There's a place on the cord where the covering has come off. The cord wires are bare, and they're touching each other.

When the lamp is turned on, electricity flows through one cord wire toward the lamp. But it doesn't get to the lamp. Why?

---

Because it crosses over to the other wire. It crosses over where the two wires touch.

Where does the electricity go after it crosses over to the other wire?

---

Right! It goes back where it came from.

Electricity always takes the shortest path. That's what it does in the cord. The two bare wires make a short path. They make a short circuit in the cord.

Get a colored pencil. In the picture, draw a line to show how electricity flows through the short circuit. Start from the outlet.

You can see that the lamp won't light up when there's a short circuit in the cord. But that's not all that happens. Too much electricity flows in the circuit. The circuit is overloaded. In the next experiment, you'll see what happens then.

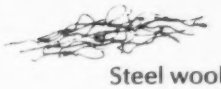
# Experiment 3
## What happens with a short circuit?

### Materials

1 six-volt battery

Your bulb and socket

Rubber band



Steel wool

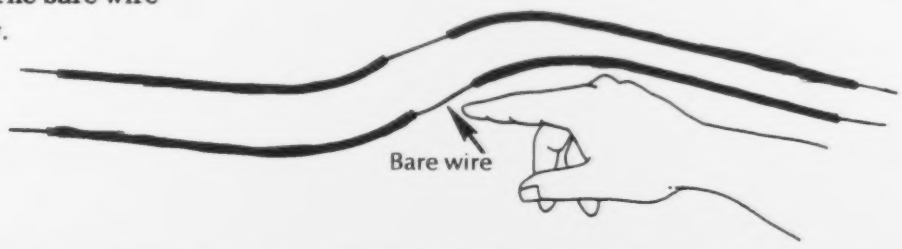
3 pieces of bell wire (each eighteen inches long) with the ends stripped

Large spool of thread

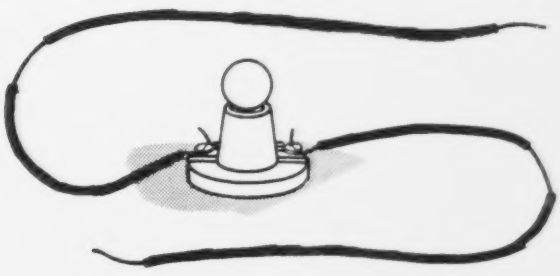
### Procedure

1. Strip off about an inch of covering from the middle of a wire. The bare wire must show.

2. Do the same with another wire.

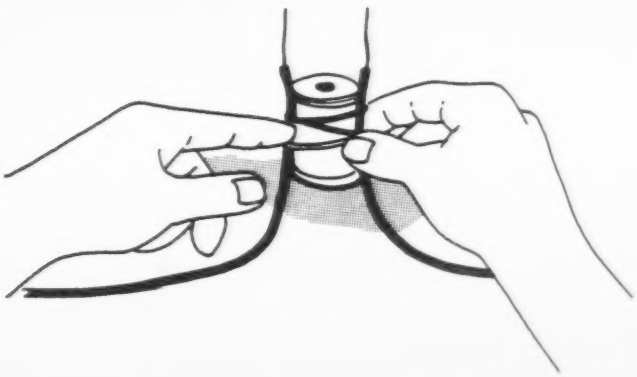



3. Connect the wires to the socket.



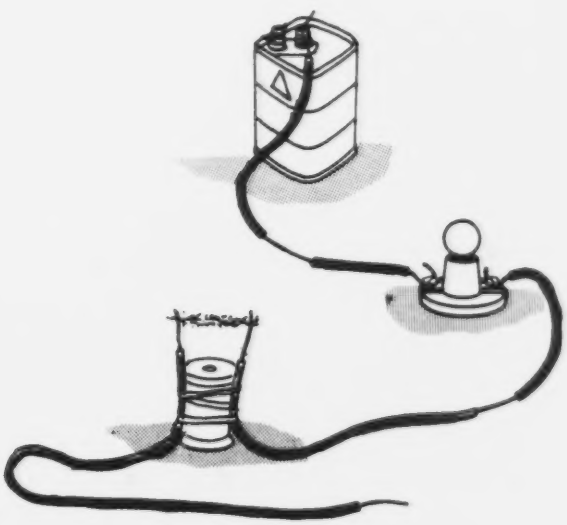
4. Pick up a socket wire and the last wire. Press the wires against the spool. Make sure that the stripped ends stick up. (Turn the page for the next step.)

5. Put a rubber band around the wires and the spool. The rubber band will hold the wires in place. Make sure the wires don't touch each other

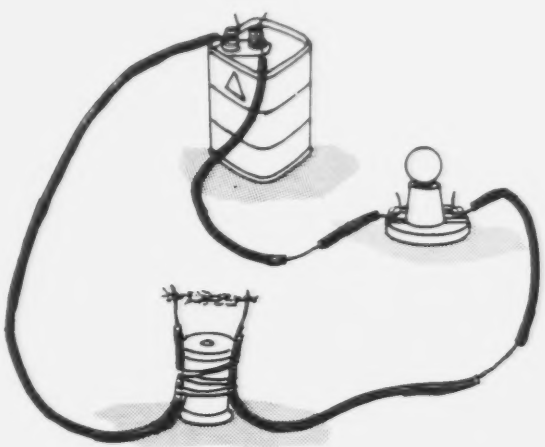


6. Take a small piece of steel wool. Stretch it out to make a thin strip. Connect the steel wool to the ends of wire on the spool.

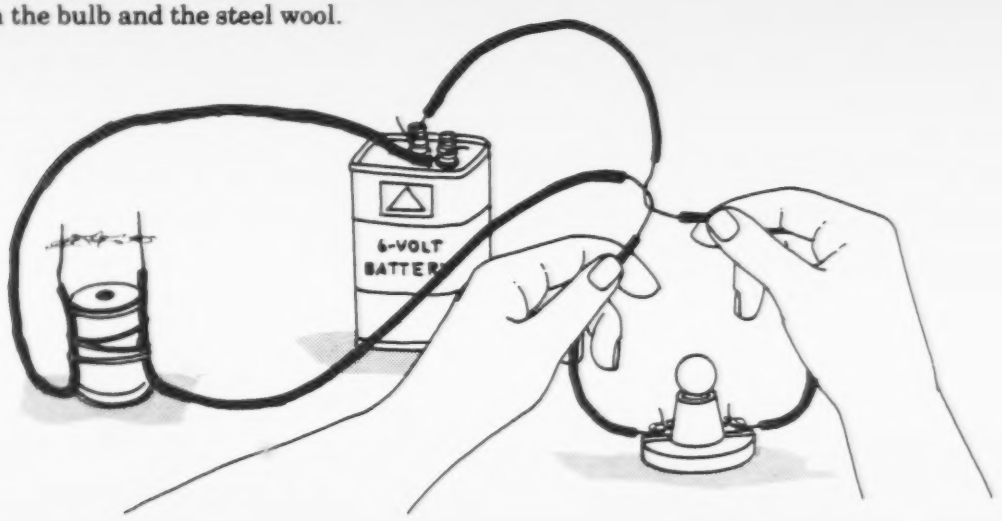
7. Connect the socket wire to a post of the battery. From now on, be careful: Don't let the bare wires touch each other!



8. Connect the wire on the spool to the other post. You've closed the circuit. The bulb should light up.



9. Pick up the socket wires. Now you can touch the bare wires together. Do it. Watch the bulb and the steel wool.




## Observations

1. What happens to the bulb when the bare wires touch?

   _____

2. What happens to the steel wool when the bare wires touch?

   _____

## Conclusions

Finish these sentences. Use these words: *overloaded, opens, electricity, short.*

1. When the bare wires touch, they make a

   _____ circuit.

2. Too much _____ flows through the wires.

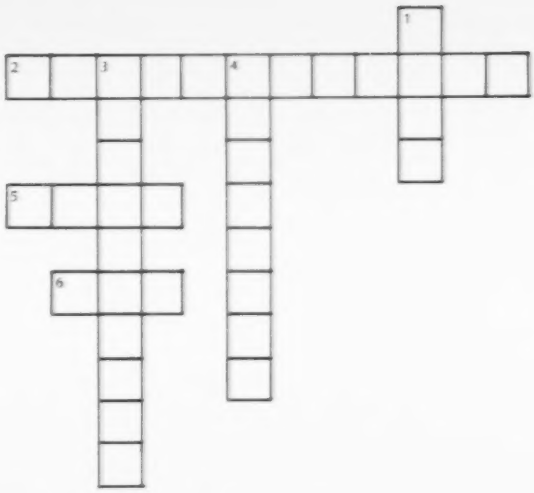
3. The circuit is _____ .

4. The steel wool _____ the circuit like a fuse.

## Check Yourself

Use words from this unit to do the crossword puzzle. The words you'll need are listed below.

| | | |
|---|---|---|
| covering | hot | short circuit |
| bare | fuse | overloaded |



**Across**

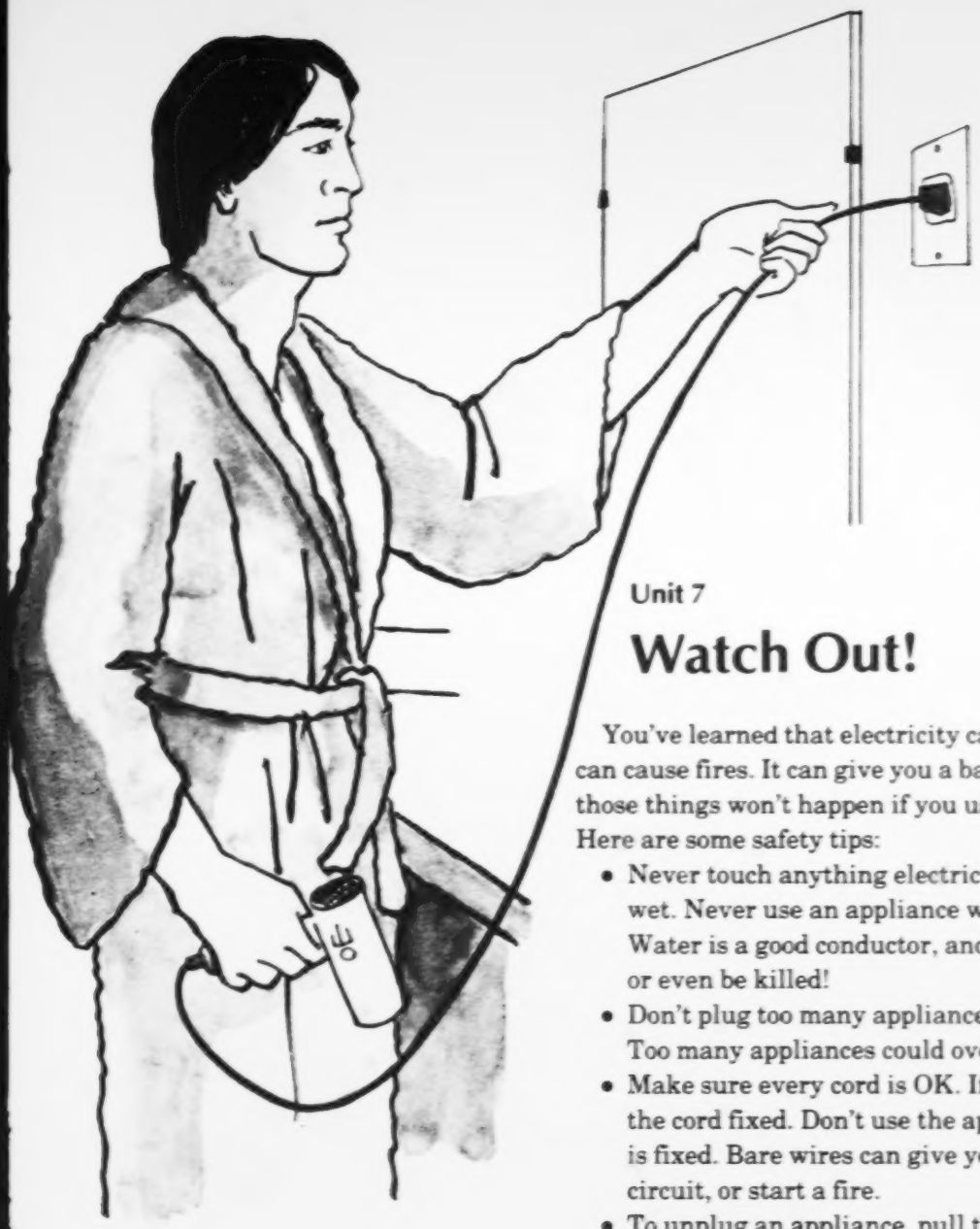
2. A short path for electricity
5. The kind of wires that make a short circuit
6. How wires get when they're overloaded

**Down**

1. What keeps a circuit safe
3. Carrying too much electricity
4. The part of a wire that doesn't conduct electricity

## Check These Out

1. Check the cords on the appliances you use at home. Find out if the covering is coming off.
2. Find out what to do when an appliance cord has a short circuit in it. Ask someone who works in a hardware store.
3. Here are more things you may want to find out:
   - What is an electric meter? How does it work? How does your local electric company use electric meters?
   - What is electronic music?
   - Why is it dangerous to stand near a tree, a pole, or an open window during a lightning storm?



Unit 7

# Watch Out!

You've learned that electricity can be dangerous. Electricity can cause fires. It can give you a bad shock. It can kill you. But those things won't happen if you use electricity the right way. Here are some safety tips:

- Never touch anything electrical when your hands are wet. Never use an appliance while you're taking a bath. Water is a good conductor, and you could get a shock—or even be killed!
- Don't plug too many appliances into one outlet. Too many appliances could overload the circuit.
- Make sure every cord is OK. If any bare wire shows, have the cord fixed. Don't use the appliance until the cord is fixed. Bare wires can give you a shock, cause a short circuit, or start a fire.
- To unplug an appliance, pull the plug — not the cord. Pulling the cord could break the covering.
- Never put a cord under a rug or in any other place where people will walk on it. Walking on a cord could break the covering.

Do you know any other safety tips? Write them here.

## What's Wrong?

Here are some pictures of people using electricity. But they're using it the wrong way. Tell what they're doing wrong. Use what you've learned.

1. What's wrong?

_____

_____

2. What could happen?

_____

_____

Why?

_____

_____

3. How could you keep that from happening?

_____

_____

48

1. What's wrong?

_____

_____

2. What could happen?

_____

_____

Why?

_____

_____

3. How could you keep that from happening?

_____

_____

1. What's wrong?

_____

_____

2. What could happen?

_____

_____

Why?

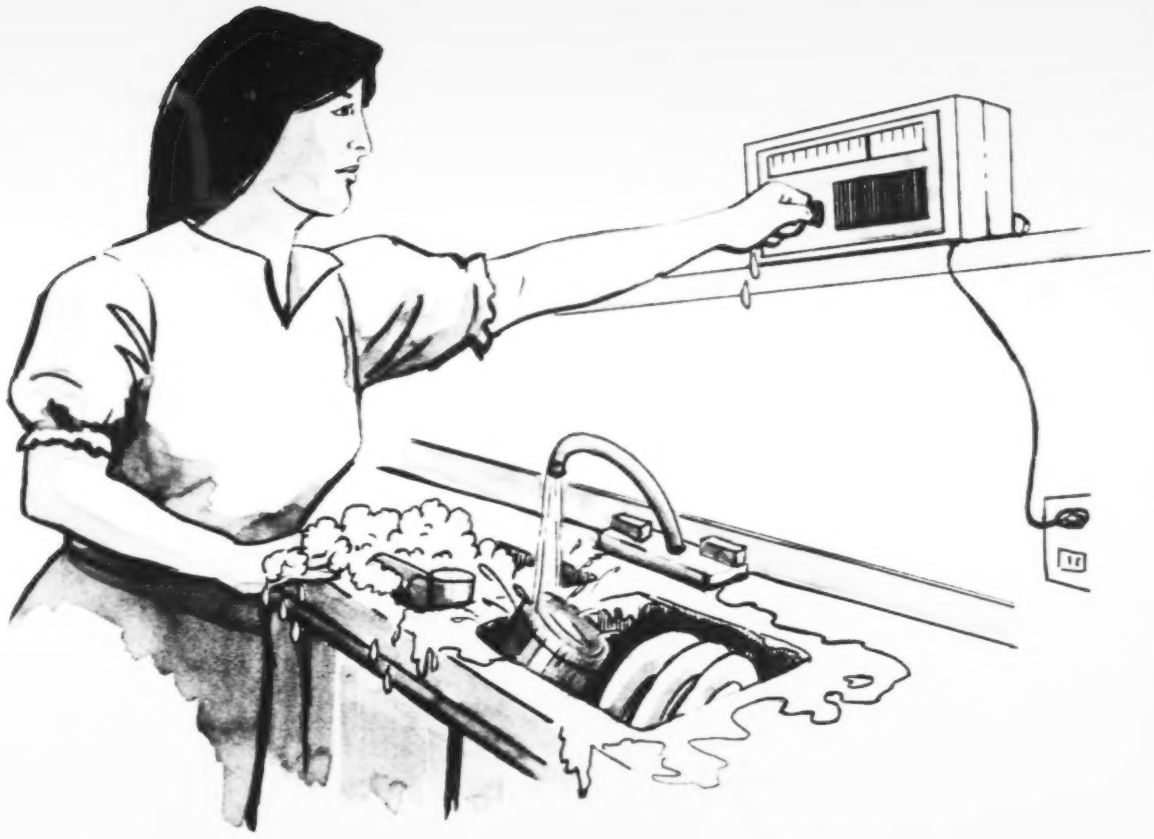
_____

_____

3. How could you keep that from happening?

_____

_____



1. What's wrong?

_____

_____

2. What could happen?

_____

_____

Why?

_____

_____

3. How could you keep that from happening?

_____

_____

# Show What You Learned

## What's the Answer?

Put an **X** in front of the right word or words. There may be more than one correct answer to a question.

1. What does electricity flow through?
   - _____ a. A closed circuit
   - _____ b. An open circuit
   - _____ c. A rubber circle
2. What conducts electricity?
   - _____ a. Water
   - _____ b. Plastic
   - _____ c. Metal
3. What does electricity make?
   - _____ a. Wire
   - _____ b. Heat
   - _____ c. Light
4. What kind of circuit is dangerous?
   - _____ a. Short
   - _____ b. Overloaded
   - _____ c. Open

## What's the Word?

Write the correct word for each meaning.

1. Special path for electricity

   C _____

2. Something that opens and closes a circuit

   S _____

3. Something that carries electricity

   C _____

4. Thin wire inside a light bulb

   F _____

5. Carrying too much electricity

   O _____

6. Something that keeps a circuit safe

   F _____

# Congratulations!

**You learned about electricity and how to use it safely!**

# Glossary

**ap pli ance**: something that uses electricity

**bare**: not covered

**bat ter y**: something that makes electricity

**bulb**: something that lights up

**cir cuit**: a path for electricity

**cir cuit break er**: something that stops the flow of electricity; a kind of fuse

**con duct**: carry something, such as electricity

**con duc tor**: something that carries electricity

**con trol**: turn on or off

**cord**: two covered wires that are stuck together

**fil a ment**: a thin wire inside a light bulb

**flow**: move in one direction

**fuse**: something that keeps a circuit safe by stopping the flow of electricity

**fuse box**: a place where the fuses for a house are found

**glows**: gives off heat and light

**in can des cent**: giving off light from a wire that glows

**non con duc tor**: something that can't carry electricity

**out let**: a place to plug in something that uses electricity

**o ver load ed**: carrying too much electricity

**posts**: the metal parts where wires are connected to a battery or a socket

**shock**: a sudden, sharp pain caused by electricity

**short cir cuit**: a short path for electricity

**switch**: something that opens and closes a circuit

JB Janus Book Publishers
2501 Industrial Parkway West
Hayward, California 94545

# Electricity

**Janus Science in Action Series**

| | |
|---|---|
| **Earth Science** | The Solar System<br>Weather |
| **Life Science** | The Five Senses<br>Green Plants |
| **Physical Science** | Electricity<br>Sound |

**Series Editor:** Winifred Ho Roderman / **Editorial Assistant:** Carol Ann Brimeyer / **Secretary:** Nancy N. Lee
**Artist:** Nancy Kirk
**Cover Photo:** Dave Christensen

**Production Manager:** E. Carol Gee / **Production Coordinator:** Elizabeth L. Tong
**Typographer:** Goodtype

**ISBN 0-915510-77-4**

54